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Methods for Forming Certain Graphic Generators on the ARM-3 Color Monitor

18630261 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 4, Apr 88 pp 25-31

[Article by Ye. I. Pecherskaya, "Kibernetika" UNPK, Tomsk]

[Text] In forming the expert automated work place (ARM-E), guided by the Klassifikator YeSKD [unified system of design documentation], a package of computer graphics programs is used to create, store and reproduce illustrated determinant items of class 71-76 parts on a color graphic monitor.

The user is offered a set of graphic generators for constructing images. Each generator is defined by a small number of points. Its formation is reduced to calculating the coordinates of points belonging to the generator in a two-dimensional space. The integral point coordinates, calculated according to the algorithm, are depicted on the screen of a raster graphic monitor. If the point coordinates go beyond the edge of the screen, the points are not depicted on the screen.

Particular attention in developing algorithms for forming graphic generators must be paid to the size and speed of their software implementations.

Algorithms for forming generators can be divided into two groups: 1) those which calculate the generator coordinates using recursive formulas in real numbers with subsequent rounding off, and 2) those which calculate generator coordinates in whole numbers.

Algorithms of the First Group

A Graphic Generator of Line Segments: this is defined by the beginning and end points of the segment.

First algorithm: we make unit increments along the axes, starting with the beginning point of the segment, having the greatest projection. Along the other axis, the increments of coordinates, corresponding to the unit increment, will be determined by the tangent (cotangent) of the angle of the slope of the line to the axis OX.

Second algorithm: we determine the beginning and end points P1 (X1, Y1) and P2 (X2, Y2). The point P (X,Y) on this line is determined by the vector combination: $(1-\alpha)P1 + \alpha P2$ for a certain real α. If $0 \leq \alpha \leq 1$, then P lies on the line between P1 and P2.

A Graphic Generating Circle: this is defined by the center point and any point on the circumference.

The coordinates of any point of the circumference with a center at XC, YC are determined according to the formulas:

$$X_{n+1} = XC + (X_n - XC)\cos P - (Y_n - YC)\sin P, \quad (1)$$

$$Y_{n+1} = YC + (X_n - XC)\sin P - (Y_n - YC)\cos P,$$

where X_n, Y_n are the coordinates of the point on the preceding step (the initial values are determined by the coordinates of the given point on the circumference);

$P = 2\pi/N$ (N is the number of points on the circumference).

The advantage of this method is the fact that P is a constant, i.e., the values cosP, sinP are calculated only once, before calculating the coordinates.

The Graphic Generator of an Ellipse: this is defined by the center point, a point on the semimajor axis and a point on the semiminor axis.

$$X = A\cos\theta, \quad (2)$$
$$Y = B\sin\theta,$$

where A -- the semimajor axis;
θ -- the angle, formed by the line from the center of the ellipse to a point on the ellipse and the semimajor axis;
B -- the semiminor axis.

The angle θ is changed at each step by the value of increment P; $\theta' = \theta + P$, where $P = 2\pi/N$ (N is the number of points on the ellipse).

$$X' = X\cos I - Y\sin I + XC, \quad (3)$$
$$Y' = X\sin I + Y\cos I + YC,$$

where I is the angle between the semimajor axis and OX.

$$\cos\theta' = \cos\theta\cos P - \sin\theta\sin P, \quad (4)$$
$$\sin\theta' = \cos\theta\cos P + \cos\theta\sin P.$$

Recursive substitution of the new values of $\cos\theta'$ and $\sin\theta'$ from expression (4) into expression (2), and of the new values of X and Y from expression (2) into expression (3) allows us to calculate all points on the ellipse.

The advantage of this method is the need to calculate cosP and sinP only once before calculating the points on the ellipse.

The Graphic Generator of an Arc of a Circle: this is defined by the center

point and the beginning and end points of the arc. This makes it possible to give the coordinates of the end of the arc only in the direction of the radius of the central angle which passes through the given coordinates. By the same token, it becomes possible for the user to define the end point of the arc approximately on the radius of the circle or of its extension.

Calculation of the coordinates of points on the arc is performed according to formula (1). X_n, Y_n initially assume the values of the coordinates of the beginning point of the arc. Exit the calculation on achieving equality of the central angle of the arc and of the accumulated increments of the angle

$$PR = \sum_{i=1}^{n} P_i,$$

where n is the number of calculated points.

The Graphic Generator of an Arc of an Ellipse: this is defined by the center point, a point on the semimajor axis, a point on the semiminor axis and the beginning and end points of the arc. This enables us to give the beginning and end points only approximately as the direction of the vector which passes through the center of the ellipse to the beginning (end) points of the arc.

Calculation of the points on an arc of an ellipse is performed using expressions (2), (3) and (4). In order to calculate points on the arc with the given beginning point, the angle between the semimajor axis and the vector from the center to the given beginning point G is determined, then expression (2) takes the form

$$X = A\cos G,$$
$$Y = B\sin G.$$

The calculation is finished when equality of the central angle of the arc and the accumulated increments of angle PR is achieved.

Algorithms of the Second Group

A Graphic Generator of Line Segments. For the initial value of the actual coordinates, the coordinates of the beginning point are assumed. Unit increments are carried out along the axis having the greatest projection. The periodicity of the appearance of unit increments along the other axis is proportional to the ratio of the projections onto OX and OY.

Graphic Generators of a Circle and an Ellipse. The algorithm is based on the method of the estimation function F. The essence of the method lies in the fact that, as a result of a step along any controlling coordinate, the auxiliary functions F_x,F_y are calculated. The sign of the function determines the direction of the next step. The displacement which arises as a result of the step causes the calculated coordinates of the point to approach the ideal for this generator. For that part of the generator located in Quadrant I, calculation of the estimation function is implemented using recursive formulas.

For a circle:

$$F = F' + 2X + 1, \tag{6}$$
$$F = F' - 2Y + 1, \tag{7}$$

where F' is the value of the estimation function in the preceding step.

For an ellipse:

$$F = F' + B^2(2X + 1), \tag{8}$$
$$F = F' + A^2(-2Y + 1), \tag{9}$$

where A is the semimajor axis and B is the semiminor axis.

The selection of expressions (6), (8) or (7), (9) is determined by the sign of F.

If $F \geq 0$, we make a step along the X-axis, and if $F < 0$, we then step along the Y-axis. Each point calculated in Quadrant I is reflected in Quadrants II, III and IV. The advantage of this algorithm is that the generator is simultaneously calculated in all four quadrants.

The ellipse thus calculated is canonical. In order to obtain an ellipse with a center at XC, YC and an angle I between the semimajor axis and OX, the formulas:

$$XP = XC + X\cos I - Y\sin I, \tag{10}$$
$$YP = YC + X\sin I + Y\cos I,$$

are needed, where XP, YP are the coordinates of the real ellipse; X, Y are the coordinates of the canonical ellipse.

The Graphic Generators of an Arc of a Circle and Arc of an Ellipse. In order to enable the user to approximately assign the beginning and end points of the arc of an ellipse and the end point of the arc of a circle, it is necessary to compute their precise coordinates.

For the arc of a circle:

$$XT = \frac{R1(X2 - XC)}{R2}, \tag{11}$$
$$YT = \frac{R1(Y2 - YC)}{R2},$$

where XT, YT are the precise coordinates of the end point; R1 is the radius, drawn to the beginning point of the arc; X2, Y2 are the given coordinates of the end point; and R2 is the radius, drawn to the end point of the arc.

For the arc of an ellipse:

We obtain the coordinates of the beginning and end points in the corresponding canonical ellipse:

$$X1P = (X1 - XC)\cos I + (Y1 - YC)\sin I, \tag{12}$$

$$Y1P = -(X1 - XC)\sin I + (Y1 - YC)\cos I,$$
$$X2P = (X2 - XC)\cos I + (Y2 - YC)\sin I,$$
$$Y2P = -(X2 - XC)\sin I + (Y2 - YC)\cos I,$$

where X1, Y1 -- the coordinates of the beginning point;
XC, YC -- the center coordinates;
X2, Y2 -- the coordinates of the end point;

we determine the precise coordinates in a canonical ellipse:

(13)

$$Y1T = \pm\sqrt{\frac{X1P^2A^2B^2}{B^2X1P^2 + A^2Y1P^2}}$$ the sign of the root is determined by the sign of Y1P;

$$X1T = \pm\sqrt{\frac{A^2B^2 - Y1P^2A^2}{B^2}}$$ the sign of the root is determined by the sign of X1P;

$$Y2T = \pm\sqrt{\frac{Y2P^2A^2B^2}{B^2X2P^2 + A^2Y2P^2}}$$ the sign of the root is determined by the sign of Y2P;

$$X2T = \pm\sqrt{\frac{A^2B^2 - Y2P^2A^2}{B^2}}$$ the sign of the root is determined by the sign of X2P.

By the precise coordinates of the initial and end points, the variant of the arc's location in the generator is defined (according to the membership of the beginning and end points of the arc in each of the four quadrants). Let us assume that from the beginning point the arc travels clockwise toward the end point. There are 16 variants of location in all. A block exists for each variant, in which the membership of the points of the arc is defined.

We further calculate the points of the generator using an integral method. All of the calculated points pass through the corresponding block. If a point belongs to the arc, it is depicted on the screen. If not, the next point of the generator is calculated. The points of the arc of a canonical ellipse are converted into the points of the arc of a given ellipse:

$$XP = XC + XE\cos I - YE\sin I, \qquad (14)$$
$$YP = YC + XE\sin I + YE\cos I,$$

where XC, YC is the center point; XE, YE is a point of the canonical ellipse; and I is the angle between the semimajor axis and OX.

If a small and easily solved block, which does not periodically omit a certain number of points, is included in a program which implements any method, then it is easy to obtain a dotted line, dot-and-dash line, etc. from the continuous line of the graphic generator.

In the process of creating the computer graphics package for the ARM-E, guided by the Klassifikator YeSKD, the characterized algorithms were implemented on the RAFOS operating system (algorithms of the first group--in Fortran IV, of the second, in Assembler).

On considering the two groups of algorithms in terms of memory size and efficiency, the following conclusion is possible:

Integral algorithms occupy less memory space and exceed algorithms of the first group in terms of efficiency: for line segments--by a factor of 3.1; for a circle--a factor of 3.2; for an ellipse--a factor of 3.3; an arc of a circle--3; and an arc of an ellipse--3.3. The experiment was based on the cyclical execution of the calculation of 100 generators with identical initial parameters.

In terms of calculating of the generator coordinates, the algorithms of the first group are more accurate. However, since the generators are not being formed on paper, but on a graphic display screen, their coordinates should be integrals; accuracy is established within one point of the raster. The deviation of generators calculated according to the second group algorithms does not exceed one point of the raster.

Thus, in utilizing a raster display within the ARM-E for the reproduction of illustrated determinant items of parts of the Klassifikator YeSKD, it is expedient to use the integral methods for forming generators. Such an approach makes it possible to increase efficiency by virtue of the correspondence between the accuracy of integral methods and the parameters of the duplication equipment.

UDC 025.4:002

Basic Directions of YeSKK TEI and USD Development in the Period Until the Year 2010

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88 (signed to press 4 May 88) pp 1-4

[Article by N.N. Fedotov, candidate of technical sciences, Yu.V. Markin and V.P. Davydova, candidates of economic sciences, GNITsVOK, 2480 copies]

[Text] GNITsVOK, jointly with ministerial and departmental head organizations for union-wide classifiers of technical and economic information (OK TEI) and for unified systems of documentation (USD), within the framework of the planning of standardization work, has defined the basic directions for developing the Unified System for Classification and Coding of Technical and Economic Information (YeSKK TEI) and USD.

The scientific prospects for the creation, managing, development, improvement and application of the YeSKK TEI and USD as standard means of providing information [informatsionnoye obespecheniye] for national economic management, should be considered in five directions.

The first direction is that of scientific research and development in the area of YeSKK TEI, which involves:

--the creation and development of a modern theory for standardizing and unifying elements for providing information [informatsionnoye obespecheniye] for national economic management;

--the study of correlation ties between YeSKK TEI and USD, the development of methods for interfacing OK TEI and USD, and their practical implementation in automated management systems;

--the research and development of equipment and methods for the automated identification and classification of products and other TEI items;

--the study of areas for the efficient use of classifiers;

--the improvement and development of a store of normative and technical documentation (NTD) on the classification and coding of technical and economic information under the new economic conditions;

--the design of NTD and the conversion of OK TEI codes into bar codes;

--the study of problems with coordinating the All-Union, sectorial and enterprise TEI classifiers within the functional subsystems of automated management systems.

The second direction is that of scientific research and development in the area of USD, involving:

--the standardization of technology for the exchange of technical and economic information and for document flow systems;

--the working out of scientific grounds for forming documents and optimizing the document circulation system;

--the improvement of the system for managing and applying USD in the sectors for purposes of reducing the quantity of sectorial documents;

--the unification of terms for indicators used in the unified documents and their coordination with OK TEI terms;

--the improvement of document circulation technology in sectorial ASU on the basis of USD.

The third direction is the development of scientific research regarding the system for the classification and coding of CEMA TEI:

--the development and improvement of systems for the classification and coding of TEI in order to support cooperation with foreign countries, in particular, the coordination of the Foreign Trade Unified Commodity Nomenclature (YeTN VT) with the CEMA OKP and the Harmonized Nomenclature, bar coding, etc.;

--the research and development of the Unified System for Classification and Coding of Technical and Economic Information in order to solve problems regarding the specialization and cooperation of industries within CEMA member countries.

Given the present ever-increasing volumes of information in the area of YeSKK TEI and USD, it is necessary to further develop the automation of information processing and the subscriber service process, which is provided for through the development of computer equipment, communications devices, office equipment and micrography.

The development of automation for managing OK TEI is assigned to the fourth direction--the research, development and improvement of automation processes in the area of YeSKK TEI and USD. It includes:

--the improvement of the classifier data base management system presently being used, with a conversion to the use of DBMS and their industrial application in the sectors;

--the conversion to network information processing technology, which stipulates the creation of distributed data bases and the use of video terminal equipment for displaying and reading OK TEI information;

--the use of mini- and micro-computers for the automated managing of classifiers;

--the practical implementation of inter-computer exchange of OK TEI information based on the principles of decentralized access to data bases;

--the development and introduction of sector-wide TEI classifier banks and the creation of classifier files for sectors (republics) on computer media;

--ensuring information compatibility between TEI classifiers and the sectorial data banks;

--ensuring the generation of information data bases according to the guidelines of the State Automated System for Scientific and Technical Information (GASMTI) and according to the classifiers, included in the YeSKK TEI;

--ensuring the development of sectorial (republic) systems (subsystems) for managing the OK TEI and the USD;

--the development and application of automated information analysis and management systems for the nomenclature of products being produced;

--ensuring the integration of systems (subsystems) for the automated managing of classifiers.

The implementation of these directions will promote the replacement of paper media for OK TEI information with paper-less subscriber-service technology.

Research and experimental design work on the possible use of expert systems (supercomputers) with intelligent interface elements for information processing in the area of YeSKK TEI and USD are outlined in the prospects up to the year 2010.

The fifth direction involves research and development on fundamentally new applied tasks:

--the creation of methods for the effective use of OKP in controlling the technical level and quality of production;

--the formation of special-purpose product nomenclatures, required for the comprehensive solution of national economical management problems, on the basis of OKP;

--the devising of methods for optimizing product nomenclature on the basis of OKP;

--the solution of problems in providing state management agencies with complete product nomenclature data and data on product normative and technical support.

The latter trend combines research with development, the results of which will enable us to place the performance of expert examination, identification and state registration of a product, as well as the evaluation of its technical level, on a scientific footing.

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Product Information Under Conditions of National Economic Management Reform

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88 (signed to press 4 May 88) pp 4-7

[Article by N.N. Fedotov, R.A. Sergiyevskiy and L.M. Saltsovskiy, candidates of technical sciences, GNITsVOK, 2480 copies]

[Text] The restructuring of the management system and economic methods touches upon a broad range of economic and organizational questions, related to solving problems of accelerating the country's socioeconomic development.

Planning is an instrument for implementing economic policy. In the process of economic reform the bounds of centralism in planning are being changed. It is being proposed that only the most important types of products be centrally determined: those which shape economic structure, are fundamentally new, and decisively influence the proportional development of the economy.

An extensive variety of enterprise plans will be determined by state orders and by direct orders on the basis of economic contracts between manufacturing enterprises and consumers. The economic contract should ensure active enterprise participation in forming plan decisions, which makes it possible to achieve a balance of all basic plan positions in the detailed product nomenclature. The consumer influences the formation of the necessary product assortment via the contract.

The reform of the economic mechanism requires a new treatment of administrative information. Within the country's industrial infrastructure a new sector has been singled out--the provision of information [informatsionnoye obespecheniye] for the national economy. Under the conditions of conversion from predominantly administrative to economic management methods, limitation of centralism in planning, and reduction of funded material and technical supply, the role of unified, centralized information on the management objects and, above all, on the product as the final goal of national economic industrial processes, is increasing.

In this regard, the further application of All-Union Classifiers for Industrial and Agricultural Production (OKP), which is a systematized code for the names and codes of all products sold in the country and provides for name standardization and uniform product coding, is of great significance.

The formation of OKP and the existence within it of a classification section (K-OKP), in which the product is grouped according to its most important features, and an assortment section (A-OKP), in which the product is identified with regard for specific types, models, parameters, types of use, configuration, etc., make it possible to use a classifier in all spheres and at all levels of management.

Thus, the K-OKP is used more extensively in planning and statistics, while the A-OKP is used in material and technical supply and price setting.

An important product-identifying feature of the OKP is the designator of the normative and technical document (NTD) according to which the product is manufactured. This makes it possible to consider the OKP not only a unified information language, but also an information method of standardization.

However, currently the OKP is not being fully utilized in the processes of controlling the nomenclature and the product's technical level and quality.

The economic reform stipulates the consumer's leading role in determining the assortment of goods produced, i.e., the consumer is gaining the opportunity to select the specific product of the necessary type and the manufacturers are being placed under competitive conditions. Thus, control over the product nomenclature and over its technical level and quality should become a predominantly economically regulated process.

A problem faces the producer--what kind of product to make, as well as the consumer--what kind of product to order.

The solution to the producer's problems should be based upon marketing, i.e., technical and economic market studies of supply and demand in various industries.

The consumer's problem should be solved through cataloging, i.e., the systematic technical and economic description of the products.

Marketing and cataloging can be successfully performed, assuming comparable nomenclatures and the assurance of classification and product designation uniformity, which can be achieved using the OKP. In this regard, whereas the unified classifier (OKP) is supplementary in marketing, it forms the basis of a catalog.

The catalog contents are determined by the purposes and tasks of its creation. In this aspect, the catalog should present the consumer (customer) with the necessary amount of information about the basic indicators and parameters of various products in a systematized form at various grouping levels.

Product information can be presented through technical-economic and scientific and technical data.

The basic technical and economic data on products are contained in the normative and technical documentation (NTD) and in technical level charts, as

well as in other standardization documents (for example, data on the results of attestation and state tests and advertisement data).

Scientific and technical data are also available in materials from scientific and technical information agencies (for example, review information and information lists from scientific and technical information centers).

A product catalog might include the following information: the OKP specification (code, product name, NTD designator), basic data (parameters, characteristics and indicators contained in the NTD and in technical level charts), and additional data (parameters, characteristics, and indicators contained in other documents).

Since NTD and technical level charts are coordinated with the OKP in terms of product names and designators, it is not difficult from the organizational viewpoint to draw up the basic catalog data. The centralized drawing up of supplementary data, such as scientific and technical information documents that are not coordinated with the OKP, is more labor-intensive. However, whereas the basic catalog data should be unified and mandatory for all product types, supplementary data should be put together in a decentralized manner depending on the type of product.

Presently, the OKP includes products sold to industry. Moreover, the existence within the catalog, in addition to information on products which are being made, of information on products which have not yet found application or been registered as an invention or discovery, i.e., patent information, is of significant interest to those who order products (particularly configured sets of items). In this connection, the inclusion of prospective products (or coordination of the OKP with the International Classification of Inventions) in the OKP is topical.

Given the available data processing equipment and information systems, it is justifiable to consider partially cataloging the basic types of products, machine building products above all, which is feasible from the technical and organizational aspects.

The use of product information, cataloging and marketing in "producer-consumer" relations under the new economic conditions will contribute to solving the most important problems of restructuring--ensuring uniformity and cooperation in the planned development of the national economy and of commodity-monetary relations; the use of information catalogs when ordering provides for nomenclature optimization by raising product quality, technical level and degree of unification.

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Use of OKP Codes by Machine Building Enterprises

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88
(signed to press 4 May 88) pp 7-11

[Article by V.V. Levenets, 2480 copies]

[Text] Different categories of classifiers are used in machine building enterprises in order to code products distributed by material and technical supply agencies: the All-Union Classifier for Industrial and Agricultural Production (OKP)--the assortment sections; classifiers used in the USSR Gossnab system; and enterprise classifiers.

The names of identical objects (supply items), as well as the content of the information given about the objects, differ within these classifiers, which creates difficulties in the identification of supply items. In this regard, the USSR Gossnab system uses 10-digit OKP codes.

For example, in the All-Union Classifier for Industrial and Agricultural Production the code 4212130781 corresponds to the name "MTP-100 General-Purpose Industrial Indicating Manometer," and the class of precision of the manometer is indicated as -1.5 [1], whereas Ukrglavpribor uses the name "MTP-100 Technical Manometer" with a similar code for the very same type of product.

These differences lead to difficulties not only when determining the codes for specific supply items, but also when enterprises draw up consolidated orders for materials and purchase items.

USSR Gossnab accepts orders drawn up in complete accordance with the classifiers used in its system. Therefore, the USSR Gossnab classifier system is more useful (compared to the OKP) in a number of machine building enterprises. This is also due to the fact that they are frequently re-issued, annually in some cases; changes in them are sent to enterprises more regularly, than changes in the OKP classification section (K-OKP). However, generalized (standard) names for separate specifications are found in them, which simultaneously include several assortment types (for example, 4212131000 vacuum manometers and MTPSd-100 ship vacuum manometers), which complicates the identification of supply items, as well as the fact that a number of

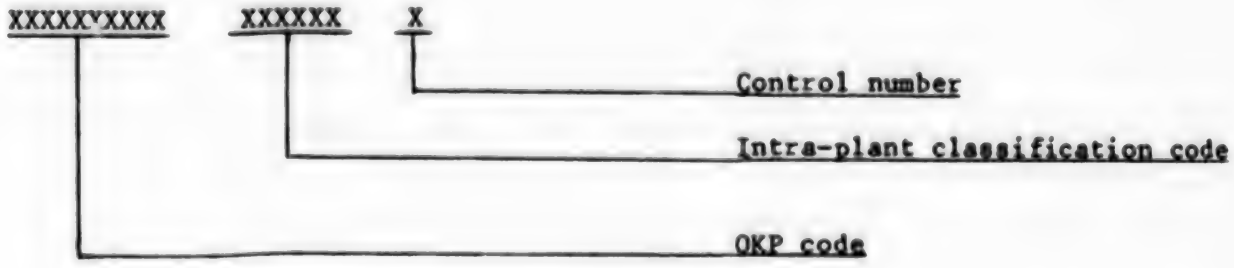
indicators are lacking that are required for classification and coding in enterprises.

Therefore, in order to code the MTP-100 technical manometers in an enterprise classifier, it is expedient to take into consideration features reflected in the technical criteria for excess pressure gauges, vacuum pressure gauges, and the MTP, VTP and MVTP (TU 25-02.181071-78) indicating vacuum manometers, particularly: the type of use (ordinary), measurement limits (for instance, 0-0.06, 0-0.16, 0-0.4, etc.), and the medium to be measured (liquid, steam, gas).

The lack of necessary information creates a need to develop and utilize enterprise classifiers in order to solve ASUP problems (within the framework of the enterprise).

In order draw up consolidated orders for USSR Gossnab, its own classifiers are used and, out of necessity, table-translators are used as an intermediate document that establishes a correlation between [illegible]ise classifiers and those of USSR Gossnab, requiring additional outlays [illegible]ir development.

Experience attests to the expediency of creating a clas[illegible]or for the machine building enterprise, which will take features needed in [illegible]er to solve intra-plant problems and USSR Gossnab cooperation problems into consideration in its code structure. Inter-related classifiers and price-lists have been developed for this purpose, in which the 17-digit codes for supply items have the following structure:

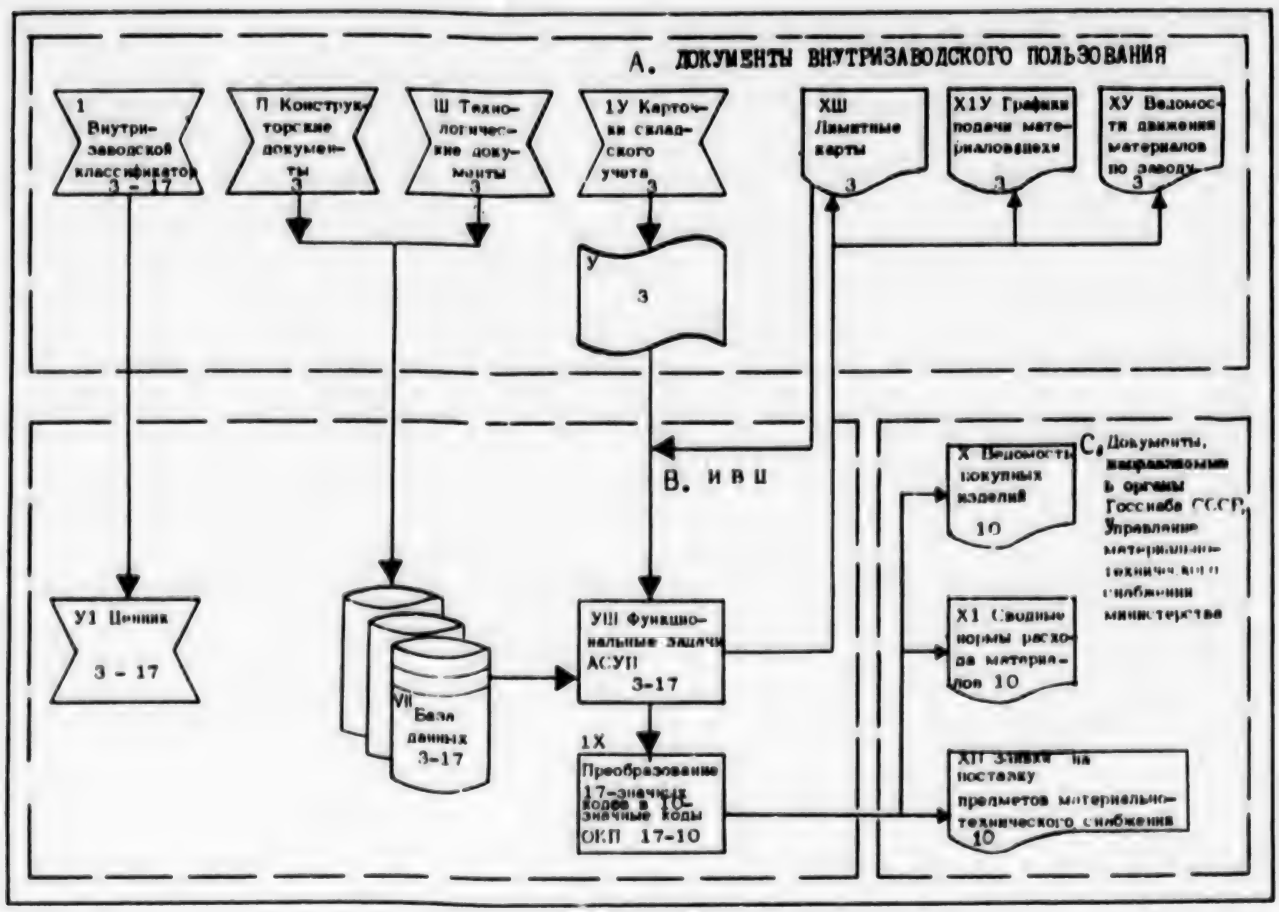


The intra-plant classification code is used for those features of supply items not taken into consideration by the USSR Gossnab classifier system. For the MTP-100 technical manometer in particular, such indicators are: type of use, measurement limits and medium to be measured.

However, the labor-intensiveness of completing documents using the suggested 17-digit coding method increases and, as a result, the probability of occurrence of errors increases [2].

Therefore, in addition to the classification code, it is expedient to assign an identification code (registration number) to each supply item (specification), for use within enterprise documents. As a rule, in enterprises with single-item or small-scale production, the nomenclature of

supply items consists of up to 50,000 specifications. This nomenclature can be designated as a 3-digit code, utilizing alphanumeric symbols.



Key: I. Intra-plant classifier; II. design documents; III. technological documents; IV. warehouse stock card; VI. price-list; VII. data base; VIII. ASUP functional tasks; IX. conversion of 17-digit codes to 10-digit OKP codes; X. list of purchase items; XI. consolidated material outlay norms; XII. orders for material and technical supply; XIII. limit charts; XIV. schedule for material supply to shops; XV. lists on movement of material through plant; A. Intra-plant Documents; B. Information Computer Center; C. Documents sent to USSR Gossnab agencies and material and technical supply administrations of ministries.

In an enterprise classifier, price-list and ASUP data base, codes correspond to each specification: 3-digit alphanumeric (identification) and 17-digit (classification) codes.

The proposed plan for using supply item codes at an enterprise is shown in the figure.

The numbers 3, 10 and 17 indicate that 3-, 10-, and 17-digit supply item codes, respectively, are given on paper or magnetic media.

The sources of the codes and their basic areas of use are represented by blocks I-XV.

Either 3-digit or 17-digit codes are used in solving intra-plant problems, depending on the specific nature of the problem (block VIII).

When drawing up documents for USSR Gossnab, as well as for the material and technical supply administrations of ministries, the consolidation of 17-digit codes into 10-digit OKP codes is performed (block IX).

The proposed system has the following advantages: the labor-intensiveness of work and the probability of errors in those cases in which supply items are coded by identification codes are reduced, and it becomes possible to regulate supply items according to classification groups using a computer and computer-aided preparation of documents with OKP codes for USSR Gossnab and the material and technical supply administrations of ministries.

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UDC 002:006.354

GOST 6.10.5-87 "Standardized Documentation Systems. Requirements for Designing Standard Forms"

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88 (signed to press 4 May 88) pp 11-13

[Article by L.M. Azarenkova, GNITsVOK]

[Text] Currently there are 15 standardized documentation systems (USD) functioning in the country, in which form and content requirements for documents used in planning, statistical accounting and other areas of management are standardized.

The elaborated GOST 6.10.5-87 "Standardized Documentation Systems. Requirements for Designing Standard Forms" (replacing the previously functioning set of state standards with specific USD), was first approved in March 1987 and went into effect 1 January 1988.

The standard establishes basic requirements for the design of standard forms for the development of document forms standardized on their basis, considering the possibility of processing them by computer, and for the manufacturing of document blanks.

GOST 6.10-5.87 extends to documents at all levels of economic management (with the exception of capital construction, design, technological and foreign-trade documentation, as well as organizational and management documentation).

The USSR and union republic ministry (department) determine the need to develop a standard form.

The standard form can be represented as a drawing containing a plan for the positioning of essential items, or as a description of the essential items which indicates their sequence and space occupied, which takes into account the specific features of the reciprocal arrangement of essential items.

The standard determines the following paper formats for standardized document forms: A3, A4, A5, and A6, according to GOST 9327-60. The use of other paper formats is permitted for separate document forms, which are being established by the ministries (departments) which design the USD.

The standard form determines the following margin sizes, no less than

1) for the face side of the page:
   --the margin for binding (left or top)--20 mm,
   --the left (when binding at the top), top (when binding on the left), lower and right margins--10 mm;

2) for the reverse side of the page:
   --the margin for binding (right or top)--20 mm,
   --the right (when binding at the top), top (when binding on the right), lower and left margins--10 mm.

A construction grid for the standard form is formed by the intersection of vertical and horizontal lines on paper of the established format, bounded by the margins. A construction element of the document form being designed is a construction grid cell, bounded by the neighboring vertical and horizontal lines.

The standard form zones are located within the basic sections of the standard form.

Two zones are established within the standard form's heading section:

Zone 1--for the location of items essential for the document's heading section;

Zone 2--for the location of codes for items essential to the heading section.

A special zone should be allocated within the content section of the standard form for essential items which are subject to further processing on office or computer equipment.

One zone is established within the official registration section.

Standardized document forms should contain the following essential items:

name of the form,
code for the form,
name of the organization which drew up the document,
code for the organization which drew up the document,
date of the document,
permanent essential items of the document,
signature.

The structure of additional essential items for the standard form is defined within normative documents, drafted or approved by the ministries (departments) which develop the USD.

Standardized document forms are drafted when it is necessary to form

indicators in order to solve management problems.

Duplication of indicators in different document forms is not permitted.

The names for essential items in the standardized document form should correspond to those adopted in the All-Union Classifiers for Technical and Economic Information (OK TEI).

OK TEI codes are used in standardized document forms intended for union-wide use. Within the names of graphs, in which the spacing of OK TEI codes is stipulated, it is recommended to indicate the classifier code according to the All-Union Classifier for All-Union Classifiers (OKOK).

The development and application of GOST 6.10.5-87 ensures uniformity in the requirements for the structure of standardized document forms of different administrative levels, permits a significant reduction in the number of existing state USD standards and increases the efficiency of office and computer equipment use.

UDC 002.002.235:65.011.56:681.3

Improving Management Document Forms by Standardizing Them for Computerized Information Processing

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88 (signed to press 4 May 88) pp 14-19

[Article by I.A. Yevstegneyeva and Ye.M. Krivonosova, "Soyuzgazavtomatika" VNPO]

[Text] Standardized document forms are one of the elements for providing information [informatsionnoye obespecheniye] for OASUgazprom [Sectorial Automated Management System for the gas industry]. An important feature of the standardized form is its orientation toward the automated processing of the information contained within documents created according to this form.

However, this feature is not always regarded as independent, regardless of the fact that attempts are made in a number of cases to single out basic features, the presence of which makes it possible to consider a document form standardized [1].

GOST 6.10.1-80 "Standardized Documentation Systems. Basic Regulations" included a requirement for the maximal suitability of standardized document forms for automated information processing (T.2.1), but it is not covered in detail.

At the same time, the possibility of automated (without preliminary manual) processing of the information in documents created according to a form should be considered a significant criteria for relating this form to the standardized forms.

The transfer of information from a traditional (paper) document onto computer media should be performed without the intermediate operations of readying it on blanks of a certain size and without manually coding the essential items in each document. It has been established that intermediate operations require time outlays that exceed the time needed to punch in the input information by a factor of 2-3.

Requirements are formulated below for the design of standardized document forms, oriented toward automated information processing.

The problems solved by an organizational and economic ASU, as a rule, include processing statistical reporting and plan information from input documents which are created according to inter-sectorial forms used union-wide. Work [2] proposes the typification of such forms, on the basis of which requirements for their improvement can be promoted and their suitability for automated information processing can be ensured.

Form typification was performed in consideration of the fact that administrative document forms have heading, content and official registration sections. In terms of entering information into a computer, this means that each form includes fixed constant information (for example, the headings of lines and columns with their codes or ciphers) and variable information, which is filled in when documents are created.

The fixed constant information should meet the requirements of GOST 6.10.1-80: it should be entered into the computer only once (it can be corrected in the future as needed), yet is repeatedly used (for example, when printing forms, by addressing the appropriate dictionary).

A specific feature of fixed constant information is the fact that it is entered and corrected before beginning the execution of a task.

Variable information is entered at every reporting and plan period with the number (code or cipher) of the line. It can be addressed, called up to the display screen or printed on query, and used to form output documents, which permits control of plan and factual data.

This concept of a form indicates that, in order t[illegible]nter it to a computer, the fixed constant section must be standardized, while the input frame for variable information should be constant and independent of the type of form.

Work [2] showed that many inter-sectorial forms, addressed in OASUgazprom and oriented toward automated information processing, can be reduced to three basic types.

The first type of form has a fixed line-column structure and is the most widespread. In these forms, the number or cipher for the line and column are clearly fixed for an indicator with a certain name. To a great extent, such forms meet the principle of standardization, yet they also have shortcomings, which are manifested during computerized information processing.

Thus, the lines within each section of one form in many cases are numbered starting with one. This necessitates the additional processing of the section number, so that the indicator being entered has only one definition.

The list output sequence for the lines does not correspond to the ordinal number of the line. For example, form 1-Automotive Transport requires printing first line 976, then lines 961-968, and then line 977. This makes it necessary to assign the lines additional local numbers that reflect their print sequence. Changing the print sequence of the lines can be performed using software as well, yet in order to do this, special programs reflecting the printing features for specific forms would be required, instead of

standardized software which makes it possible to create and print a large number of documents.

Certain lines (for example, "including" or "of which") do not generally have numbers, although the information included within them is also subject to processing.

So that forms of the first type satisfy the principle of standardization for computerized information processing, it is expedient to enumerate all lines throughout the form on the whole regardless of section numbers, and to assign the lines numbers in multiples of ten. Thus, the appearance of additional indicators will not displace previously assigned numbers.

The second type of form is distinguished by the fact that their lines lack a set of names for the indicators being input. The names of report indicators are filled in by organizations arbitrarily, depending on the nature of the organization's activity: the report documents of different organizations use different names.

Among documents created according to forms of the second type, those in which indicators are printed not by lines in succession, but by sections in terms of several features that differ by rank, are also found. For example, according to form 10-2 PMTS of the "Material and Technical Supply Administration" subsystem, not only the final data for material on the whole, but also data on each expense break-down, as well as final data and a list of planned products in each sub-sector within the limits of one expense break-down (since one type of product can be manufactured from different materials, used in different expense break-downs and "passed through" different sub-sectors), should be printed in the document lines for each type of material (raw material). In each case, the names of these indicators are printed under different ordinal numbers.

In order to computer process the information from documents created on forms of the second type, a preliminary systematization of information which is subsequently included in report documents and the use of union-wide, sectorial or local codes for the appropriate documents is necessary. Thus, one code will correspond to an indicator with a certain name, regardless of which ordinal number information from different organizations is entered under. This code will be an information entry code.

In order to coordinate codes according to all the features of the planned indicators, it is expedient to create a single codifier, which contains a set of different code combinations, selected from different classifiers in a definite sequence. Having assigned a local line code to each combination of several codes, it can be used when entering operations information and when printing. This makes it possible to reduce errors when punching in information, since each line of operations information will be punched in with its local code instead of the separate codes from different classifiers; a program (during input) will "assign" a combination of codes, previously entered into computer memory, to the local code.

Forms of a mixed type can be found which contain sections designed according

to forms of both the first and second types. So that mixed type forms, which use different coding methods, satisfy the principle of standardization, it suffices to arrange sections, designed according to the second type of form, by the latter. In this case, the standardization requirement for forms of the first type, related to establishing a line enumeration throughout the document, will also be observed.

In the third type of form (as opposed to the two preceding) several information lines containing variable information (for instance, lines with names of work, performed at a given stage by different executor organizations) corresponds to one line name (for example, the specific work stage). In particular, this might be a plan document, in which volumes of work are distributed among a number of organizations of one or several ministries.

As a rule, documents created according to this type of form contain information for solving the most important problems, assigned to the ministries by the central administrative agencies. Inter-sectorial scientific and technical programs on the most important problems of the long-term development of the gas industry, unifying up to 40 percent of the scientific development work of all USSR Mingazprom organizations and up to 70 percent of that of its head scientific research institutes, can serve as an example [3]. In most cases, such documents are created by specialists on the specific problems of a number of organizations in different ministries and are unsuited for automated information processing; they must be manually prepared for input to the computer.

Experience in the automated processing of information in documents created according to the third type of form has made it possible to clarify the following shortcomings.

The names of the planned indicators or of the types of work simultaneously contain fixed constant and variable information. For example, in such a form one might find the following name of a standard work stage: "to introduce assemblies to the site at a rate of 3 units annually in 1989-1990." The extents of introduction are not indicated according to the years of the 5-year period; these are variable information and should be modified later on. If this information is formed as fixed constant information, it may be "unavailable" for analysis in the future.

The system for designating work stages and programs is incomplete and requires further manual operations to prepare information for input to the computer, since there is no monosemantic correlation between the cipher for a standard stage and its name. For example, within one document, innumerable different names, which overload the computer memory with large blocks of information, may correspond to a standard stage with an identical cipher.

In the information lines, only the names of their distinguishing features without codes (for example, the names of the executor organizations) are found, which requires manual code entry.

So that forms of the third type satisfy the principle of standardization and are suitable for computerized information processing, it is necessary to

develop a coding system which ensures a monosemantic correspondence of the cipher for a standard stage to its name, and to include additional columns in the form for filling in all-union codes for the executor organizations and information on all characteristics of planned indicators that need checking.

For any type of form, columns containing fixed constant information must be designated using letters; they must be located in front of the columns containing variable information and in front of the listed figures. Columns relating to these types of information must not be given alternately (this occurs, for instance, in form 12-Construction).

The elaborated system of requirements for standardized forms makes it possible to improve information processing technology, to avoid creating intermediate documents, to prepare fixed constant information and variable information for transfer to computer media at the document creation stage, to ensure information reliability, as well as to create standardized software for processing it.

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UDC 025.4:382

Coordination of Unified Foreign Trade Commodity Nomenclature With CEMA OKP

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88
(signed to press 4 May 88) pp 19-23

[Article by V.A. Zakharov and R.A. Sergiyevskiy, candidates of technical sciences, GNITsVOK]

[Text] One of the basic problems in applying the General Classifiers for Industrial and Agricultural Products of CEMA Member Countries (OKP CEMA) to the practical work by CEMA agencies, as well as by the international economic organizations of CEMA member countries, is using it to solve foreign trade problems, particularly for standardized accounting of foreign-trade operations and for representing mutually comparable information on the foreign trade development of CEMA member countries. Presently, these problems are solved using the Unified Foreign Trade Commodities Nomenclature (YeTN VT) of CEMA member countries.

The simultaneous use of two independent classifiers--the OKP CEMA and the YeTN VT--to solve interrelated problems of national economic planning, production, material and technical supply, standardization and export-import of the most important products of CEMA member countries makes it impossible to compare data, complicates the performance of analytical work and, to a significant extent, reduces the efficiency of computer equipment use.

In order to ensure data compatibility when solving said tasks, proposals have been drafted, according to instructions by the Executive Committee of the CEMA Comprehensive Work Group (KRG) on OKP CEMA, for coordinating the OKP CEMA with the YeTN VT, which stipulate the work structure and sequence, the basic methodical and organizational tasks in coordinating the OKP CEMA with the YeTN VT, and a subsequent transition to the use of the OKP CEMA in all tasks involving the mutual cooperation of CEMA member countries.

Coordination involves a set of task, including creating a transitional key between the YeTN VT and the OKP CEMA, convergence of the YeTN VT and the OKP CEMA, and ensuring the coincidence of OKP CEMA and YeTN VT reference numbers.

The transitional key is a table of YeTN VT reference numbers cross-referenced with the OKP CEMA codes. Convergence of the OKP CEMA and the YeTN VT is implemented through rational changes made in the YeTN VT or OKP CEMA

classification features, and by ensuring a monosemantic interpretation of the reference numbers and the standardization of their names within the YeTN VT and the OKP CEMA.

The basic difficulties in coordinating the reference numbers of the YeTN VT and the OKP CEMA are:

--difference in the classification features;
--failure of reference numbers to coincide in terms of concept contents;
--difference in terminological definitions reference number content.

In order to solve foreign-trade statistics problems, the coordination process stipulates inclusion in the OKP CEMA of sections (commodity structure) of the YeTN VT, configured equipment, construction products, work and services of a material nature, as well as the most important types of foreign trade commodities, data on the export and import of which are published in the statistical collection "Foreign Trade of CEMA Member Countries."

As a result of designing a transitional key, conditions will be created for the comprehensive application of OKP CEMA within CEMA activities.

Preparation of a draft transitional key is being carried out by the USSR delegation of the Comprehensive Work Group. Ministries (departments) and organizations, which participate in the planning, accounting and statistical accounting of foreign trade and which perform export-import operations, were involved in work on the draft.

The transitional key takes the form of a table of YeTN VT reference numbers cross-reference with OKP CEMA codes, which preserves the location sequence of reference numbers used in the YeTN VT. The table includes the following information: the YeTN VT code, the name of the YeTN VT reference numbers and the OKP CEMA code.

The source materials for coordination are the "Unified Foreign Trade Commodity Nomenclature of CEMA Member Countries" (fourth edition), the "Foreign Trade Commodities Bulletin" (supplement to the fourth edition of the YeTN VT), the "Catalog of Most Important Foreign Trade Commodities," from the statistical collection "Foreign Trade of CEMA Member Countries," and the "Explanation of the Content of Commodity Reference Numbers in the YeTN VT."

Coordination of the YeTN VT with the OKP CEMA is being performed in stages and includes the following basic steps:

--analysis of the content and names of YeTN VT reference numbers;
--definition of OKP CEMA reference numbers, equivalent to YeTN VT reference numbers in terms of content (designing a table for coordinating the YeTN VT with the OKP CEMA, as well as drafting suggestions for changes and additions to the OKP CEMA and the YeTN VT);
--formation of a transitional key.

In the analysis process, the content and names of the reference numbers are established:

--the content of YeTN VT reference numbers, based on the YeTN VT context and explanation;
--the presence of an OKP CEMA group (groups) and (or) of assorted OKP CEMA reference numbers, which can be correlated with YeTN VT reference numbers;
--the correspondence of YeTN VT and OKP CEMA reference numbers in terms of content;
--the difference in the content of YeTN VT and OKP CEMA reference numbers;
--the correspondence of the product name with contemporary terminology;
--the monosemantic nature of the names;
--the technical product naming, based on the commercial name given in the YeTN VT;
--the applicability of YeTN VT reference numbers in CEMA agencies and in CEMA international economic organizations (MEO).

The comparison of names in the YeTN VT and the OKP CEMA is performed, taking the names of higher reference numbers into account.

The names of reference numbers in the YeTN VT and the OKP CEMA are considered coordinated in the following cases:

--given the coincidence of concepts and means of their expression, for example: "bleaching powder"--in the YeTN VT, and "calcium hypochlorite"--in the OKP CEMA;
--when the names of the reference numbers in the YeTN VT and the OKP CEMA are equivalent modern synonyms for the product name;
--when a name in the YeTN VT and the OKP CEMA additionally contains synonyms, for instance: "potassium fluoride (fluoride of potassium)"--in the YeTN VT and "potassium fluoride" in the OKP CEMA;
--when a name in the YeTN VT and the OKP CEMA contains additional explanations that do not change the concept content, for instance: "sodium sulfite (sulfite of sodium), except that used in photography"--in the YeTN VT and "sulfite of sodium (sodium sulfite), technical"--in the OKP CEMA;
--when terms in the names of YeTN VT and OKP CEMA reference numbers differ by number, case and word order.

The standardized names of reference numbers in the YeTN VT and the OKP CEMA which correspond to each other are adopted and the necessary changes in the YeTN VT or the OK CEMA are made, according to the outcome of coordination.

In the event of divergence of product group features in the YeTN VT and the OKP CEMA, a comparative analysis of these features is performed, on the basis of which one of the following decisions is made:

--to adopt a standardized product grouping system in the YeTN VT and the OKP CEMA;
--to encode the YeTN VT reference number using the OKP CEMA 10-digit neutral code.

For example, the YeTN VT classifies tractors according to type of motion (Caterpillar treads or wheels) and according to engine capacity, yet the OKP CEMA classifies according to purpose, traction class and engine capacity. Since tractors are machines intended to perform certain technological operations (and are not self-propelled power plants), a fact which is reflected in foreign trade practice in tractor catalogs and brochures, classification according to features adopted in the OKP CEMA is preferable.

The specific YeTN VT reference numbers are coded in groups (including neutral), specially delineated by the Comprehensive Work Group on the OKP CEMA. In addition, YeTN VT sections and reference numbers in CEMA statistical collections are included in an established order within the OKP CEMA, using 6-digit neutral codes or using classification group codes in accordance with the OKP CEMA hierarchical structure.

The transitional key includes the approved names (standardized within the YeTN VT and the OKP CEMA).

The managing of the transitional key is to be carried out by coordinating reference numbers, subject to supplementary inclusion in the YeTN VT and published in periodical foreign trade commodities bulletins (supplements to the YeTN VT), with the OKP CEMA.

UDC 025.4.002.235

Basic Aspects of Improving the System for Managing All-Union Product Classifiers (by Way of Discussion)

18630265 Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 6, Jun 88 (signed to press 4 May 88) pp 23-28

[Article by O.V. Komar and N.Ye. Terekhov, 2480 copies]

[Text] A necessary condition for the efficient application of ASU and computer equipment in enterprise (association) management is the use of the Unified System of Classification and Coding of Technical and Economic Information (YeSKK TEI).

Some of the most important administrative tasks of production manufacturing enterprises include: the formation of production and material and technical supply plans, technological production engineering, the drafting of price-lists, etc.

Solving said tasks using ASU under the new economic conditions requires the more immediate (no more than 1 month) provision to enterprises of information on the codes for technical and economic items.

The immediate and qualitative maintenance of classifiers in an up-to-date condition and the provision of information on the codes to subscribers should be ensured through a system for managing classifiers.

Table 1 cites the basic indicators for the status of work in 1984-1986 to implement the all-union classifiers being used in the sector. Table 2 reflects the status for providing information to subscribers of OK TEI management in the sector, according to the item codes over the same years. The tables were compiled on the basis of the work experience of a sectorial head organization for OK TEI. From the tables, it follows that the length of time it takes the ministries and departments responsible for developing OK TEI to inform subscribers of the classifiers and changes in them consists of from 5.4 to 16.4 months; the time delays in considering one request for the acquisition of codes (above the set time period--no more than 1 month) consists of 2.9-7 months.

Table 1.

Year	Indicators and their Values				
	N	V_E	K_{izb}	T_p	T_E
1984	36	54.581	0.4	4.2	5.4
1985	81	134.665	0.2	10.8	16.4
1986	115	226.404	0.33	6.2	7.93

Note: N is the number of publications of change booklets (notifications of changes), obtained by the sectorial head organization from the ministries and departments, responsible for development of OK TEI;
--V_E is the quantity of reference numbers in N change booklets;
--K_{izb} is an indicator of printing quality of the change booklets (the ratio of the number of reference numbers which prove useful for circulation, to the overall number of reference numbers in N change booklets);
--T_p is the average length of time (in months) it takes for the developer of the classifier to inform the sectorial head organization of the changes;
--T_E is the overall length of time (in months) it takes to notify the subscriber enterprises of the changes.

Table 2.

Year	Indicators and Their Values		
	K_{sv}	T_z	K_{kach}
1984	0.7	2.9	1.0
1985	0.6	7.	1.0
1986	0.7	4.2	1.0

Note: K_{sv} is an indicator of timeliness in considering requests (the ratio of the number of requests, the answers to which arrived on time from the ministries and departments responsible for developing OK TEI, to the overall number of requests for acquisition of codes, directed to other ministries and departments);
T_z is the average time delay in considering one request beyond the set time period;
K_{kach} is an indicator of the quality of consideration of requests (the ratio of the number of reference numbers not containing errors in the codes and control numbers to the overall number of reference numbers in the requests).

Thus, the existing procedure for maintaining the OK TEI in an up-to-date condition and the provision of information to subscribers of the system for managing OK TEI does not permit timely solution of enterprise (association) ASU tasks.

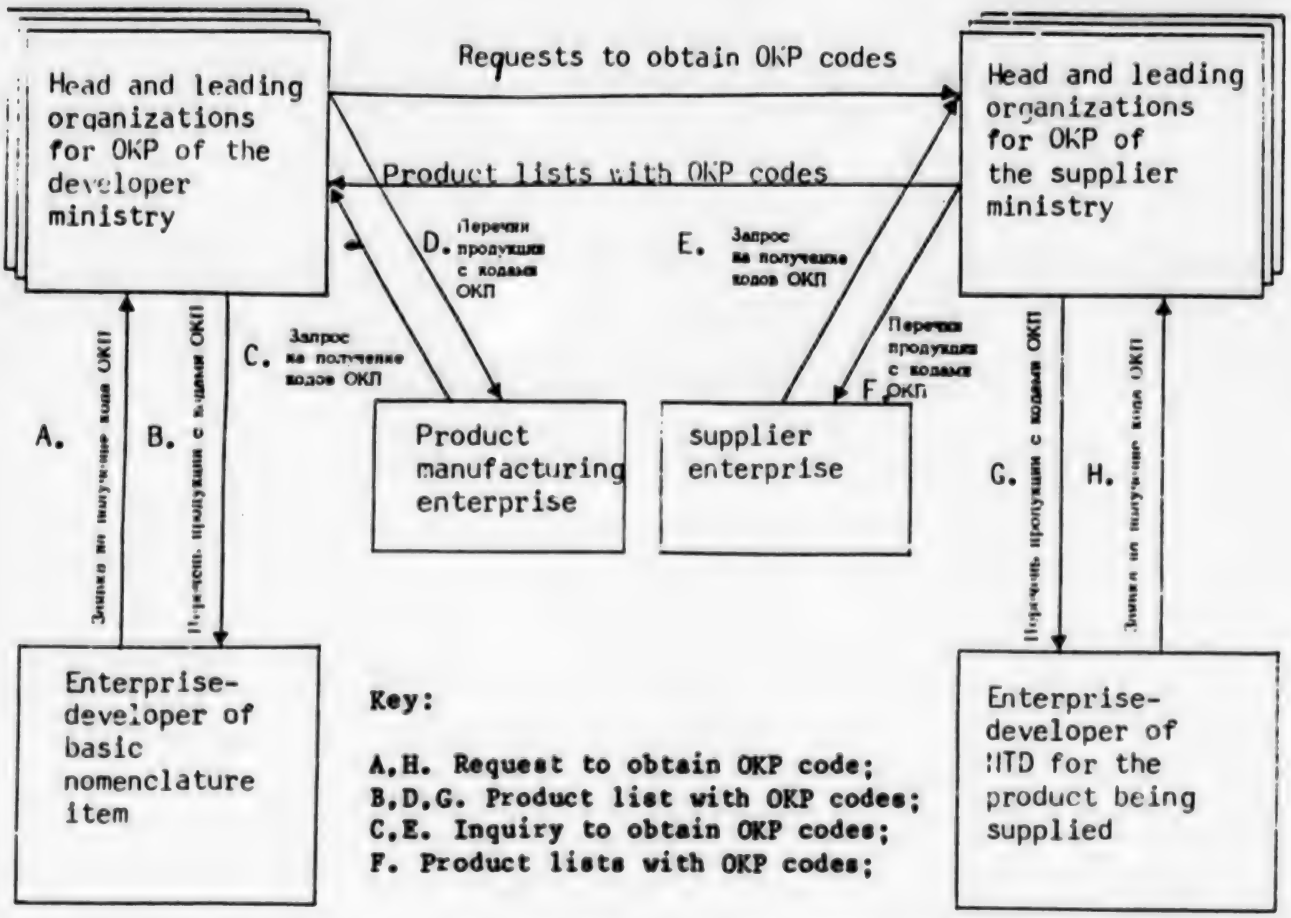
The basic reasons for this are as follows:

--the multi-level nature of the existing system for providing information to subscribers;
--the lack of communication between product manufacturing enterprises and supplier enterprises on said problems;
--the cumbersome nature of procedures for approving and ratifying OK TEI and changes to them.

A flow chart for the existing procedure for providing information on product codes to subscribers is given in figure 1.

Figure 1.

Flowchart of Existing Procedure for Providing Subscribers With Product Codes



Key:

A,H. Request to obtain OKP code;
B,D,G. Product list with OKP codes;
C,E. Inquiry to obtain OKP codes;
F. Product lists with OKP codes;

For purposes of creating an effective system for maintaining the All-Union Classifiers for Industrial and Agricultural Products (OKP) in an up-to-date condition and for improving the provision of information on product codes to subscribers it is expedient:

--to apply a system for providing subscribers with information, which

stipulates direct communication regarding codes for products being produced and consumed between the manufacturing enterprise and the product developing enterprise and supply enterprises;

--to simplify the procedure for approving and ratifying OKP and making changes to it, in particular, granting the possibility of:

--coordinating them in the classification section of the OKP (K-OKP) with the product customer only;

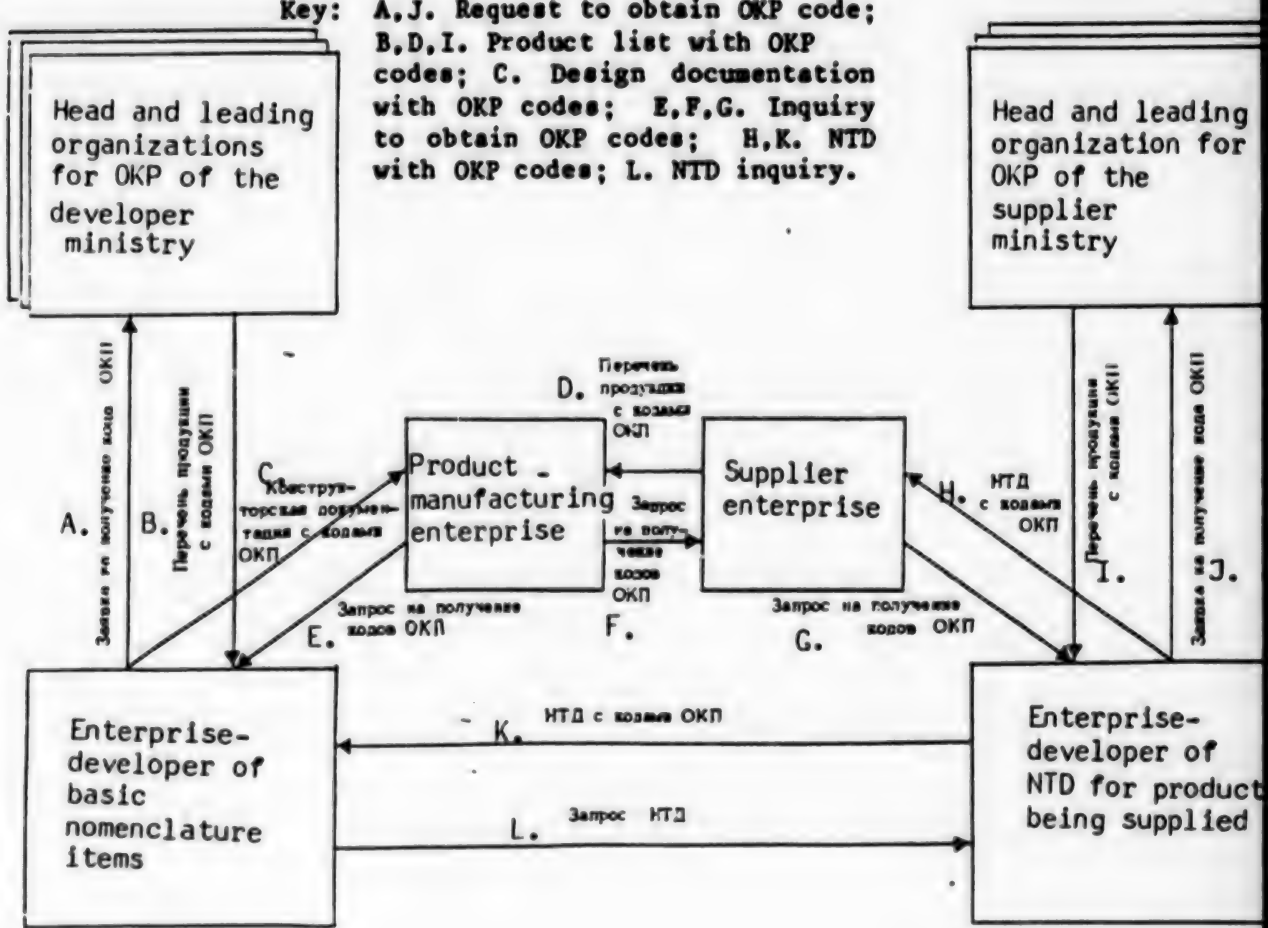
--coordinating them in the assortment section of the OKP (A-OKP) for items of the basic nomenclature with the product customer only, and their ratification by the head organization for OKP;

--ratifying the A-OKP for complete sets of items and for spare parts without coordination by the head organization for OKP.

The flow chart for the proposed procedure for providing subscribers with product codes is show in figure 2.

Figure 2.

Flow Chart of Proposed Procedure for Providing Subscribers With Product Codes



In order to implement these proposals it will be necessary:

- --to include OKP codes in design documentation (in particular, in specifications);
- --to establish the mandatory nature of using OKP codes in normative and technical documentation (NTD), as well as in other documentation originated when designing the product;
- --to ensure control by material and technical supply planning agencies and the marketing of the product after using the OKP codes.

These measures will contribute to increasing the effectiveness of the operation of the system for managing OKP.

UDC 681.3.06

Space-Time Transformation of Parallel Microprograms

18630272b Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Mar 88 (manuscript received 30 Sep 86) pp 129-140

[Article by O. L. Bandman, Novosibirsk]

[Abstract] The development of homogeneous parallel processing structures has three stages: 1) The transition from a problem written in formulas to the best execution-in-parallel algorithm; 2) The transition from the mathematical description of the algorithm to the algorithmic description of the device executing the algorithm; 3) The transition from the structural configuration to the engineering design. This analysis of stage 2 construct those formal transformations of parallel and pipeline computing processes that, by extending the process in time, fit it into a specified space. A technique is found for changing from an algorithm for parallel substitutions (a parallel microprogram) on a k-dimensional data array to an equivalent algorithm on a (k-1)-dimensional array. The method excludes the k-coordinate from the microcommands and adds microcommands for shifting the data along this coordinate. The necessary and sufficient conditions which the original microprogram must satisfy in order to assure the determinacy and equivalency of the computing process are determined. The transform is illustrated with three typical cases: 1) A binary cellular adder for adding m n-digit numbers; 2) A dynamic coincidence search processor, in which the parallel microprogram is derived by the space-time transformation of the microprogram of an associative memory; 3) A linear convolution process. The formal basis of the transformation (the parallel substitution algorithms) offers the hope of automating this procedure, which until now has been more of an engineering art, although it forms the foundation of architectural compilation. An appendix adduces proofs of the underlying theorems. Figures 7; references 12: 10 Russian, 2 Western.

UDC 658.52.011.56

Design Models and Methods for Structure of Multiple Loop Automated Process Control Systems

18630272a Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Mar 88 (manuscript received 18 Dec 86) pp 106-117

[Article by V. K. Akinfiyev, V. P. Kostyuk, A. F. Rezchikov and A. D. Tsvirkun, Moscow, Saratov]

[Abstract] The automated process control systems for power management in an industrial enterprise require optimal designs when implementing comprehensive automation. These designs have multiple control loops with complex interactions between the components. This paper proposes a simulation and optimization approach to control system design based on a building-block and decomposition description, a graph formalization of the system structure and the representation of the design procedure as an interconnected set of tasks involving the selection of system structure variants and the evaluation of system operating dynamics. This selection is formalized as an integer programming problem. The general analytical solution is predicated on the consideration of the algorithmic, functional, data, hardware and topological structures in the multiloop system. The optimization and simulation procedure is illustrated with a flow chart incorporating all the above structural elements and it is applied to the determination of the structure of the process control system for power management in an industrial enterprise of the machine-building industry. Some 55 possible design variants were considered, which contained 12 different algorithm structures. The generation of the structural variants required 1.5 hours of machine time; the time needed to find one permissible variant based on the analytical constraints was a function of the type of structure and ranged from 0.5 to 6 minutes, while each structural variant could be checked with the simulation model for the two operating modes of the facility being considered in approximately 50 minutes. The computers were SM 1420 machines running under the RAFOS operating system. A diagram of the final selected system illustrates the relative configuration of the transducers, actuating mechanisms and components of the remote control system. The proposed models and techniques have been used in the design of power control systems of machine building enterprises and have enabled the application of efficient structural variants of the management system for a group of enterprises. Figures 2; references: 5 Russian.

UDC 519.68:681.51

Principles of Category Approach to Representation of Knowledge. I. Category Facilities

18630276 Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 88 (manuscript received 2 Feb 87) pp 21-23

[Article by Ye. M. Beniaminov, Moscow]

[Abstract] This article discusses mathematical facilities for representation of knowledge for automated processing. The category approach is suggested as an alternative to semantic networks. Based on the apparatus and methods of the mathematical theory of categories, this approach differs from the network approach as the relational approach to modeling data bases differs from the network data base model. It is assumed that knowledge can be represented as a set of areas, systems of relationships and mappings, but with less severe requirements for completeness of the represented information. The category approach to representation of knowledge is a natural development of the relational appraoch to data bases, supplemented by the ideas and methods of abstract data types. Facilities used in the mathematical theory of categories for representation of knowledge are informally described. Knowledge is represented in the category approach by algebras with well developed sets of category theory operations, giving the algebras a well studied structure, as well as the structure of a reflexive category. Only categories which are constructed in a certain sense and finitely defined are sensible for use in computers. The categories may be infinite, but at any moment in time processing of the knowledge represented by the categories deals only with finite fragments of the categories, called finite approximations of the categories. The mathematical object constructed to model a system of knowledge is an algebraic topos, the properties of which are fixed by the corresponding operations. Each representation of a concept is coupled with a definition, a category and a finite approximation of a category. The category reflecting the full knowledge concerning a concept is a constructive algebraic object, but the object is ideal in the sense that the algebra of all integers is ideal. The finite approximation of a category approximates the infinite category as the system of machine numbers approximates the algebra of all integers. References 13: 6 Russian, 7 Western.

UDC 536.5

Contact Thermometers With Optical Operating Principle

18630110b Moscow IZMERENIYA, KONTROL, AVTOMATIZATSIYA in Russian No 2, Aug 88 pp 31-40

[Article by T. Ya. Cherepanov, candidate of technical sciences]

[Abstract] Optical contact thermometers do not require galvanic coupling between the temperature sensing element and the remainder of the measurement device, allowing measurement of temperatures where electrical, magnetic and electromagnetic fields are present. These devices may measure the amplitude, phase, spectral composition or attenuation time of the optical radiation which is modulated by temperature. The operating principles are described for amplitude sensors, pyrometric sensors, phase sensors, spectral sensors and time sensors. Optical contact thermometers, which would have seemed impossible a decade ago, are presently on the way toward broad utilization in measurement practice. Accuracies of 0.2°C have been achieved, and can be improved by yet another order of magnitude. Sensors now measure 0.6-1.2 mm in diameter. Devices with fiber-optic sensors will see broad application in medicine, electrical engineering, aviation and other areas where sensors with galvanic coupling are difficult or impossible to use. Figures 6; references 86: 30 Russian, 56 Western.

UDC 681.324:681.3.066

Multiple Criteria Control of Branches in PS-3000 Multiprocessor Computer

18630270 Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Mar 88 (manuscript received 20 Oct 86) pp 173-176

[Article by V. I. Borzenko and A. Z. Ioshpa, Moscow, Severodonetsk]

[Abstract] The process of allocating branches for an application running under the operating system of a PS-3000 computer is optimized so that the minimum execution time is achieved through the selection of the appropriate branch. The central problem is the automatic sorting of an arbitrary set of objects represented by points in a parameter space which is matched to the structure of the system administrator's preference. This proposes a special approximation method for the automatic allocation of the queue of requests, based on the actual preferences of the system administrator, when the preferences are correctly incorporated in the common request sorting scheme. Wehn considering a limited region in the criteria space and the structure of the preferences in a sufficiently small vicinity of each point can be approximated by a smooth usefulness function, one can use a linear approximation for this function. This enables a piecewise-linear approximation of the structure of the preferences. The greater the precision required though, the more data needed from the system administrator and the more time expended by the system for allocation, so that a compromise is made in each particular case, depending on the relative cost of the possible inaccuracy, as well as time needed for the allocation and by the administrator. A description of single criterion sorting is followed by an algorithm for the allocation of branches for the case of multiple criteria in branch selection. Allocation control based on a consideration of the behavioral history of a branch over short time intervals did not substantially reduce the program running time. When the time expended for tracking this history was chosen sufficiently great, the proposed algorithm allowed a reduction in the execution of test programs of 11 to 13% as compared to the traditional algorithm for designating system priorities. Figures 2; references: 4 Russian.

UDC 681.327.21:003.6

Semiautomatic Graphic Information Input Devices. Status and Development Trends

18630110c Moscow IZMERENIYA, KONTROL, AVTOMATIZATSIYA in Russian
No 2, Aug 88 pp 67-76

[Article by L. I. Manpil, candidate of technical sciences, and A. G. Ryzhevskiy, doctor of technical sciences]

[Abstract] Descriptions are presented of (primarily Western) digitizers, used to input graphic information to computer memory in digital form. The specifics of input data conversion in digitizers are discussed. A table lists a number of primarily American digitizers with their resolution, power consumption, board size, mass, cost and other information. It is reported that several American firms are working on three-dimensional graphic data input systems, utilizing acoustical, electromechanical and electromagnetic methods to measure the positions of points within a three-dimensional space. References 16: 6 Russian, 10 Western.

"Interprogramma:" Yesterday, Today and Tomorrow

18630259 Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 2, 1988, pp 27-31

[Unattributed article]

[Text] Machine language, the language of programming, is hardly an abstract concept. Today these are very specific means of communication between users and computers and between computers themselves. For good reason, software is one of the main focal points of the fast-paced electronics age. Its production is more and more frequently assigned to the independent production sector. Currently, without software we cannot ensure the efficient operation of any machine, from micro- to super-computers, and thereby increase man's intellectual capabilities many times over.

In 1986, an understanding of the problem and the realization of its topicality and importance led to a joint decision which at that time was difficult: the establishment of the Soviet-Bulgarian "Interprogramma" Institute in Sofia.

Presently, its members consist of the USSR Ministry of Instrument Building and the "Programmnyye Sredstva i Produkty" Economic Association of the Bulgarian Economic Council. As an international organization and legal entity, the institute enjoys legal capacity within both countries, needed in order to perform its assigned tasks: the development of applied program packages (PPP) for automated control systems (ASU) made in the USSR and the NRB, using varied types of computers.

The "Interprogramma" staff, formed on a competitive basis, consists of 300 people, including 30 Soviets. The institute is financed with budget funds comprised of equal payments by both sides.

Its work organization is characterized by dynamism and flexibility. The fulfillment of specific assignments--scientific research, software systems development, etc.--is entrusted to temporary collectives numbering from 3 to 15 people. Since a unified production structure is used here, these project groups include, as a rule, specialists from both countries. Combined with progressive programming methods, such organization promotes the growth of labor productivity: today "Interprogramma" labor productivity exceeds the average indicators of similar establishments in both the Soviet Union and Bulgaria by a factor of almost 2. Here, the most complex software systems are

developed within about 1 and a half to 2 years, i.e., twice as fast. It is no accident that the economic efficiency of developments exceeds 3 rubles per ruble expended.

The higher authority of "Interprogramma" is a bilateral council, consisting of national sections which include representatives of each country. Between council sessions, held once annually, the institute is managed by the chairman of the Bulgarian section. At the same time, its practical activity is managed by the director.

At the request of the editors, Georgiy Nikolayevich Iznar (USSR), recently appointed director, and his first deputy, Veselin Spiridonov, who has filled his position since "Interprogramma" was created, discuss the institute's achievements, unresolved problems, accumulated experience and plans for the future.

Veselin Spiridonov:

Our joint "offspring" was not created out of thin air. It would never have appeared, if not for well-laid direct ties between specialists in both countries and the close relations of two organizations closely related in terms of goals: the Soviet "Soyuzsistemprom" and the Bulgarian "Avtomatizatsiya." In 1984, they began the joint development of applied program packages, and a year later carried out the first international test. The idea of combining forces and creating a joint institute then arose. Less than a year was required to put it into practice and make it legally official. The "Interprogramma" agreement was signed on 26 May 1976. Even today, this seems like a fantastically short period of time to many people. However, there were reasons, since this solution met the spirit of the times and our countries' urgent needs for this modern type of product.

What kind of product is this? It is primarily intended for machine building automation--for automated design systems (SAPR) and for the control of flexible automated production (GAP) systems. The foremost among them, for example, SAPR-KONSTRUKTOR or GRAFKAD, were designed for extraordinarily complex problem-solving in drafting project design documentation and are in no way inferior to similar Western versions. Thus, our GRAFKAD graphics system, which is being used in design, increases labor productivity on the average by a factor of 1.5-2 and sharply affects the quality and precision of the drawings produced. Its terminal is a unique type of "electronic Kuhlman" drafting device: any correction to the drawing made by the user is reflected on the screen within moments. Using a two-dimensional computer model of real objects, GRAFKAD can automatically draw them on a graph plotter or store them in "memory."

Today work is continuing at full speed on the creation of a three-dimensional graphics modeling system, SIGMOD, which will be used in the so-called integrated SAPR, capable of automating all design stages in the development of new types of industrial production.

A great deal is also being done for flexible production automation of both the middle and lower executive level of control. Their development is tending

towards integration with high-level and SAPR systems. Operating in real-time mode, our GAP-DISPETCHER system distributes the execution of operations among production modules, directs the supply of parts and controls the course of processing.

We are also producing data base management systems (DBMS). For example, the SETOR DBMS, for large and mini-machines (YeS and SM computers) as well as microcomputers, makes it possible to organize comprehensive data processing. Non-professional users greatly need such a system. However, to accommodate the non professional user, we must apply the latest achievements in artificial intelligence. Some of our products, such as DOKUMVIT, VARITAB and MIKRO-INFO, have become popular for automating organizational activities. Most software used for this purpose in the USSR was produced by "Interprogramma."

With the appearance of high-level machine languages, the institute began to form complexes, which make it possible not only to automate programming work, but to introduce different types of computers as well. Here, I must mention the PLYuS data processing system, with which it is possible to automate the generation of applied programs. Working in cooperation with data base management systems operating in the NRB and the USSR, this system makes it possible to produce new applied programs.

How are our software products brought to the user? Mass distribution has been entrusted to national services: the "Tsentrprogrammsistem" NPO in the USSR (Kalinin), and the National Design and Software Fund in Bulgaria (Sofia). With the assistance of these organizations, our PPP undergo the mandatory experimental introduction stage in at least two economic projects in the USSR and the NRB. Our products are tested at the "Sredets" (Sofia) and "Staroruspribor" (Novgorod Oblast) plants, the Central Scientific and Technical Information Institute (Sofia), the "Atomenergoeksport" Foreign Trade Association (Moscow), the Kuybyshev Oblast Agroindustrial Complex and the Central Cooperative Union's computer center (Sofia).

Finally, our institute's departments, which have modern technical equipment and ties into a local network, also serve as a unique testing ground for experiments. Suffice it to say, we produce literally all practical information, drawings, documents and reports exclusively with a computer.

In turning over our production to the national services, namely, to those charged with selling it, we do not remain detached observers. "Interprogramma" has a special consultation bureau where we regularly demonstrate our software. Here, interested specialists can make agreements on acquiring one or another product, order training and delivery services, etc., without leaving "Interprogramma."

In only its first 10 years, over 150 different PPPs have been developed and applied in our countries by the institute. Their economic effect has exceeded 70 million rubles. In the NRB alone, more than 150 organizations, including over 40 industrial enterprises, use our institute's products.

The efficiently coordinated work carried out at "Interprogramma" assists in solving problems of "electronifying" our national economies, reducing social

labor outlays, economizing on efforts and funds, and decreasing redundancy and parallelism in carrying out important scientific and technical research. Unquestionably, this would have been impossible, if not for the creative atmosphere which has formed in the international collective, where highly skilled Bulgarian and Soviet specialists work together closely and the beneficial process of mutual enrichment with ideas, knowledge and skill takes place.

A little over 10 years ago "Interprogramma" was a unique international scientific establishment which had no analogs in CEMA. Today, when the fraternal countries are decisively restructuring integration cooperation, when new international associations of scientists and producers, joint companies and enterprises are springing up, our institute's experience can be of unquestionable benefit in arranging progressive, intensive forms of cooperation.

Georgiy Iznar:

I fully agree with Veselin Spiridonov, an "Interprogramma" veteran who has worked here from the very first day. The achieved results are impressive and enormous experience really has been acquired. Unfortunately, this includes not only positive but also negative experience. This is why I shall make bold, as they say, to put a fly in the ointment. I would like to speak of that which hinders our efforts to achieve greater practical results.

Yes, we were the first of our kind. Our international institute was formed in the mid 1970s, in accordance with rules and instructions existing at that time. Alas, today these have retained their strength, limiting our activities and in some cases acting as a brake.

The matter of selling our products is the most urgent. We are literally bombarded with suggestions regarding purchases. However, we do not have any way to fully develop this matter. Yes, we have opened a consultation bureau, for which there were many ads in the Bulgarian and Soviet press. However, everything done in it is free of charge. Essentially, we are performing normal cost-accounting services which are paid for in both the USSR and the NRB, as well as, incidentally, the rest of the world. Consequently, the solution suggests itself--converting "Interprogramma" to cost-accounting. It seems to us that business could only profit from this. I am referring not only to economic efficiency. After all, we would enter into direct ties with the users. This is exceptionally important for us, since it would promote a radical increase in the quality and scientific and technical level of our products.

The institute occupies a leading position in software, since it has highly-skilled specialists and first-rate equipment at its disposal, an excellent cadre and technical potential which could be the envy of many of the world's well-known organizations and companies. Our products are intended not so much for mass-use computer equipment, as for that which is still just being readied for production. We are proud of the fact that we work with advanced equipment, that we develop programs which are 2 or 3 years in the lead. This

category includes, for instance, the DBMS software and systems that use artificial intelligence, which Veselin Spiridonov mentioned.

Naturally, when we speak of converting to cost-accounting, we envision organizing services for the most complex applied programs. In this regard, we are willing not only to consult with the users, but also to be responsible for installing our packages, connecting them with specific hardware, and introducing them in industrial enterprises.

This is where our problem comes up: are there many organizations in Bulgaria or the Soviet Union today which are able to utilize our software, for instance, software for SAPR, expert systems or systems which use artificial intelligence? Indeed, their number is limited for the time being. And tomorrow? I am confident that a there will be a tremendous demand.

Thus, we are of two minds. On the one hand, we certainly understand how important and necessary cost-accounting is. On the other, we are somewhat afraid of conditions which, in this connection, would restrict us and do great damage to business, since someone is bound to decide that we ought to service not tomorrow's, but yesterday's software. In such a case, the institute might lose its reputation, cease being involved in research and scientific inquiry and become a supplier of mediocre software.

In considering the future one should probably not overlook an idea such as the state order. It exists in both the NRB and the USSR. Of course, we are interested in having our research and scientific developments considered for state orders and financed accordingly.

For a long time, interest has been shown in Hungary, the GDR, Poland and other socialist states in the products of the Soviet-Bulgarian institute. Hence, specialists whom we have known for quite some time frequently visit us. For example, I recently spoke with a colleague from Czechoslovakia. He suggested that we develop a product which will soon be needed in both the NRB and the USSR. Alas, we were forced to reject this idea. After all, today we work only with Bulgarian and Soviet customers. In this sense opportunities are available, and we are counting on expanding our range of clients in the future.

We are also thinking of intensifying the study of the world market for our products through joint efforts. We closely follow trends in electronics and software developments. Simultaneously, our friends in Hungary, the GDR, Poland and Czechoslovakia are doing this as well. Each country is spending enormous funds to acquire and process this information and, as a rule, they purchase it at entirely different prices, the fluctuations in which are quite substantial. We are certain that multilateral coordination would help to improve service in the area of providing information, which should be performed not only without foreign currency, but on a contractual basis as well.

Why are we placing great hopes on cost-accounting? Upon setting up service for our own products on its basis, in the final account we would be able to earn necessary funds, including those needed in order to increase our own

bonus funds and, consequently, to attract fresh, creatively active forces to the institute.

In the first place, I repeat, business will profit from this--the efficiency our international institute's work and its contribution to resolving the most important problems of "electronifying" our national economies will be radically increased.

Veselin Spiridonov:

I would like to comment with regard to our participation in implementing the KP NTP. One would imagine that we did not become participants in a number of its projects by accident, since we won prizes in the recently held "Interface-CEMA" competition. Along with a number of other CEMA country scientific centers, we have been included in a group working on developing expert systems. Frankly, however, we do not particularly notice or feel any overall coordination and we do not know which of our partners is responsible for what. Complete clarity and the strict accountability of all those involved are required here.

In turn, we are willing to increase our contribution to the common cause, to maximally aid the transition to industrial technologies in creating software systems and products.

UDC 658.52.011.56:62-505

Optimization of Computer Operation in Automated Management Systems

18630271 Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 3, Mar 88 (manuscript received 13 Oct 86) pp 118-128

[Article by S. V. Nazarov, Moscow]

[Abstract] Designing subsystems for management automation systems and configuring their components require the determination of the optimal variant; this is reduced to the solution of multidimensional variant selection problems formulated in terms of linear programming using Boolean variables and specially structured constraints on the allowable discrete set of solutions. A method and algorithm are found that take into account this multidimensionality and are based on the formulation of the problem as a critical path search in a tiered parallel graph of a special kind. Dynamic programming concepts and Lagrange factors are also used. The general analytical solution for the structure or ogranization of the operation or control of some system or process consisting of an arbitrary number of subsystems or subprocesses is ascertained with the following assumptions: Each subsystem can be realized by only one of the variants; the selection of the i-th variant for the organization of a subsystem yields a useful effect for the entire system and requires the expenditure of known resources. The overall system payoff is an additive function of the useful effects of the individual subsystems. The organizational variants of the subsystems are selected which provide the maximum payoff from the system as a whole for the specified resource requirements. The analysis interprets the variant selection task as a critical path search in a directed graph with no loops. The theoretical analysis is illustrated with numerical data for 100 to 1,000 variables with 10 constraints, 10 to 100 subsets having a set cardinal number of 10 and the precision of the solution ranges from 1% to 0.01%. The maximum number of iterations was 206, the minimum was 4, while the solution time ranged from 135.7 s to 2.55 s using a YeS-1035 computer. The data demonstrate that the proposed algorithm and technique work well when optimizing the operating processes of computer systems in management automation systems, including the dynamic restructuring of control in complex real-time systems. A mathematical proof of the underlying theorem is adduced in an appendix. Figures 2; references 11: 10 Russian, 1 Western in Russian translation.

UDC 681.3.068

Principles for Selection of Rational Ada Subset

18630269a Moscow PROGRAMMIROVANIYE in Russian No 2, Mar-Apr 88
(manuscript received 29 Apr 86) pp 3-14

[Article by A. V. Gorbunov and V. I. Limanskiy]

[Abstract] The computer programming language Ada has been criticized as t o complex and unsuitable for implementation on small computers. As a part of the struggle to define the principles for implementation of a rational subset of the Ada language, the authors studied the theoretical principles and operating mechanisms of the structures of the lnaguage which generate implicit descriptions and suggest an approach to simplification of the visibility rules by generation of a subset in which the subroutine and operation heredity mechanism is omitted and the corresponding functions are performed by renaming. As a result, all of the structures of the Ada language are left in place in the subset, but the mechanism of automatic heredity of all subroutines and operations belonging to a parent type is replaced by mechanisms involving selective redescription by a special type of renaming, retaining the useful properties of inherited types and eliminating artificial differences between the basic and redefined operations of the language, making Ada programs easier to understand and increasing their ability to survive changes during software maintenance. Figures 7; references 15: 6 Russian, 9 Western.

UDC 681,3

Fortran IV Parallel Program Analyzer

18630269b Moscow PROGRAMMIROVANIYE in Russian No 2, Mar-Apr 88
(manuscript received 7 Feb 86; revised version 22 May 87) pp 95-99

[Article by A. D. Smirnov and P. N. Telegin]

[Abstract] Location of parallel program fragments in existing Fortran programs is based on the concept of sets of input and output variables. However, various authors implicity or explicitly use different definitions for these concepts, and the question of ambiguity of the use of variables and correctness of their definition for program fragments has not been thoroughly discussed in the literature. This article presents a possible method of solving these problems, and uses it to develop an analyzer which can locate parallel code fragments in Fortran IV programs. The analyzer was written in Fortran IV and PL/1 and tested on programs of 5 to 8 thousand Fortran operators. The analyzer has been used to form the basis of a dialogue system for preparing parallel programs to be run on multiprocessor computers. The system can also be used to debug and optimize serial programs, since it can define information connections, input and output variables and portions of program which are not involved in generation of results. References: 4 Russian.

Synopses of Articles in AVTOMETRIYA, July-August 1988

18630099 Novosibirsk AVTOMETRIYA in Russian No 4, Jul-Aug 88 pp 118-122

UDC 535.21.077

Processes of Reversible Optical Recording in Chalcogenide Semiconductor Films

[Synopsis of article by K. K. Shvarts]

The state of development projects involving reversible optical recording materials for real-time information recording is examined. The physical processes of optical recording are analyzed. Special attention is given to the energy and the time of registration. Reversible recording materials for direct recording require an energy of 0.5-2.0 J/bit for a light pulse duration around 100 ns. Requirements on semiconductor lasers for optical recording are analyzed. 1 table, 46 references.

UDC 778.4.537.226:228.3:535.21

Photostructural Transformations in Amorphous Chalcogenide Semiconductors

[Synopsis of article by K. Tanaka]

Chalcogenide glasses demonstrate a broad range of photoinduced effects. Of these, the phenomenon of reversible photodarkening is of great interest, the nature of which is evidently associated with the bond structure. However, the mechanism is not entirely clear. The present article provides a survey of the photodarkening effect and related phenomena, pointing out a number of problems. A new concept of a two-phase amorphous structure is proposed to explain the structural and physical changes accompanying photodarkening. 1 table, 4 illustrations, 27 references.

UDC 666.113.32:535.212

Photostructural Transformations in Chalcogenide Vitreous Semiconductors

[Synopsis of article by V. M. Lyubin]

A survey is given of the results of experimental studies on the process of photostimulated changes in various properties of chalcogenide vitreous

semiconductors. Possible mechanisms of these changes are discussed. It is emphasized that structural transformations arising in the specimen under the action of light lie at the heart of this process. 3 tables, 8 illustrations, 50 references.

UDC 77.01:773.7

Several Aspects of an Approach to Creation of Nonsilver Photographic Materials Based on Organic Light-Sensitive Compounds

[Synopsis of article by V. I. Yeroshkin]

An approach to creation of nonsilver photographic materials based on organic compounds is presented, based on a comparative analysis of the physical and chemical properties of the organic compound and its photoproducts. 12 references.

UDC 77.021.773.71

Positive Luminescent Photographic Materials Based on Diazonium Salts

[Synopsis of article by V. I. Yeroshkin and N. V. Pavlova]

A new type of positive luminescent photographic material is described, containing diazonium salts of organic luminophores as the light-sensitive component. Photographic layers based on several diazonium salts were prepared and the spectral properties of the diazo-derivates and their photoproducts in the adsorbed state on the film and in solid solution in a polymer matrix were studied. Several photographic characteristics of the resulting photographic materials are measured. 1 table, 15 references.

UDC 535:621.373.8

Photodeformation and the Photogalvanic Effect in $LiNbO_3$

[Synopsis of article by I. F. Kanayev, V. K. Malinovskiy and A. M. Pugachev]

It has been found that additional deformations are produced during uniform illumination of a ferroelectric crystal, different from those caused by thermal expansion. It is also ascertained that the light-induced electric potential along C of crystals of $LiNbO_3$ contains a component dependent on the coefficient of absorption and duplicating the temporary form of the light intensity. This component of the electrical response and the additional deformation are associated with local heating of microdomains absorbing the energy of a quantum of light. The photogalvanic effect is explained by the drift of free charge carriers in local fields produced by the pyro- and piezoelectric properties of the crystals. 10 illustrations, 12 references.

UDC 537.311.1

Thermal Stability of Germanium Sillenites to Roasting in a Vacuum

[Synopsis of article by V. A. Gusev, V. A. Detinenko and A. P. Sedelnikov]

An investigation was performed on the photoluminescence of crystals of germanium sillenite and their change in weight when roasted in a vacuum. It is shown that the material in such case is impoverished in oxygen, bismuth, and (ultimately when the surface is ruptured) germanium. The chnages in properties (weight, luminescence) are described by activation dependencies, being of a diffusion type. The stability of the material under thermal action depends on the stability of the complex BiO_7 and, especially, the presence of oxygen vacancies in it. 3 illustrations, 5 references.

UDC 537.226.4:539.12.043

Influence of Alloyage and Radiation Treatment on Physical Properties of the Clear Ferroelectric Ceramics TsTSL

[Synopsis of article by G. Zh. Grinvalds, V. I. Dimza, S. S. Dindun, A. E. Kapenieks, A. N. Rubulis, A. A. Sprogis, U. A. Ulmanis, L. A. Shebanov, A. R. Shternberg, and R. Shtumpe]

The clear ferroelectric ceramics TsTSL 8-10/65/35 was alloyed with ions of transitional metal (Mn, Fe, Co) and lanthanides (Eu) in concentration up to 1 at.%, and the material was also irradiated with electrons (up to a dose of $3 \cdot 10^{18}$ el/cm^2) and gamma rays (up to $3 \cdot 10^9$ rad). Depending on the modifier employed and the type of ionizing radiation, various changes in the structure, the optical and the dielectric properties of the material were established. The results are interpreted on the basis of views as to the different mechanisms of incorporation of the modifier ions into the perovskite lattice ABO_3 and the redistribution of vacancies in the A, B sublattices under the radiation exposure. 2 tables, 6 illustrations, 25 references.

UDC 537.632:621.318

Optical Recording in Amorphous Ferrimagnetic Films

[Synopsis of article by K. S. Aleksandrov, V. A. Seredkin, G. I. Frolov and V. Yu. Yakovchuk]

The mechanism of thermomagnetic recording in amorphous films of alloys of rare earth and transitional metals is described. The possibility of recording analog type information in these materials is demonstrated. An analysis is made of the interaction of short pulses of light with a thin magnetic film (TMP). It is found that this produces sizable internal pressures in the film, making it possible to record in metallic magnetostriction TMP with higher energy light-sensitivity than in the thermomagnetic technique. 8 illustrations, 12 references.

UDC 621.382:537.226.4:537.246

Current State of the Amorphous Silicon Technology and Its Application in Optoelectronic Devices

[Synopsis of article by Yu. Khamakava]

The survey describes the latest achievements in the field of amorphous tetrahedral semiconductors and their application in optoelectronic devices. The first part points out a number of important advantages of these materials and examines the demands of modern technology. The second part analyzes recent scientific and experimental design work on perfection of photovoltaic cells in solar batteries based on a-Si. A survey is made of presentday achievements in other areas of optoelectronics, obtained with use of a-Si alloys, and several new directions and their technical possibilities are discussed. 13 illustrations, 40 references.

UDC 621.315.5/61:537.311.33

Ferrelectric Properties of Epitaxial Thin Film Structures of Lithium Niobate-Tantalate

[Synopsis of article by V. D. Antsygin, R. S. Madoyan, A. A. Sokolov and O. A. Khachaturyan]

The dielectric, pyroelectric and electrooptical properties of planar epitaxial structures of lithium niobate-tantalate ferroelectrics, produced by the method of liquid-phase capillary epitaxy, are investigated. It is shown that the epitaxial films are monocrystalline and possess high levels of pyroelectric and linear electrooptical coefficients. 5 illustrations, 13 references.

UDC 537.82.384.3:536.53

Noncooled CCD-Receiver of an Infrared Image Based on the Pyroelectric Crystal $LiTaO_3$

[Synopsis of article by M. Okayama, Dzh. Onishi, I. Togami and Yu. Khamakava]

A noncooled CCD-receiver of an infrared image of 64 x 32 pel format is developed, consisting of the pyroelectric monocrystal $LiTaO_3$, combined with a silicon CCD. A wafer of $LiTaO_3$, controlling the injection of charge into an MOS-gate, was connected to a silicon CCD across a layer of glycerine, having a large dielectric constant, low thermal conductance, and excellent insulating properties. The electrical capacitance of the metal-glycerine-SiO_2-Si structure was measured as a function of the applied voltage and frequency of modulation of the infrared light. It was confirmed that the surface potential of the silicon is controlled by the infrared radiation. The basic characteristics of the response of this CCD to infrared light were obatined, and an attempt at visualization of an infrared image using this receiver was carried out. 11 illustrations, 12 references.

UDC 621.382:537.226.4:537.246

Memory Effect in a Thin Film Metal-$Ba_{0.5}Sr_{0.5}Nb_2O_6$-SiO_2-Si Structure

[Synopsis of article by I. L. Baginskiy and E. G. Kostsov]

The specific nature of the memory effect in metal-ferroelectric-semoconductor structures based on texturized films of barium-strontium niobate (NBS), formed on silicon substrates by the HF sputtering method, is investigated. It is shown that thin films of NBS on silicon possess ferroelectric properties. It is established that the memory effect in the investigated structures is determined by processes of ferroele tric polarization in the NBS film, and not the buildup of a volume charge, even though the volt-farad characteristics (VFKh) possess an injection type hysteresis. It is shown that the anomalous hysteresis of the VFKh is due to shadowing of the polarization by the charge injected from the silicon through the SiO_2 sub-layer into the NBS film. The specific nature of the polarization shadowing by charge injection is studied. 7 illustrations, 21 references.

UDC 621.373.826:535.417.2

Autooscillations, Traveling Pulses and Static Stratifications in Bistable Interferometers with Competing Nonlinearities

[Synopsis of article by Yu. I. Balkarey, A. V. Grigoryants, M. I. Yelinson and Yu. A. Rzhanov]

Results are presented from a numerical analysis of the space-time dynamics of a solid state interferometer with competing concentration and thermal mechanisms of nonlinear refraction and with absorption that increases as the temperature rises. Using a numerical experiment, traveling pulses and statis nonhomogeneous structures (strata) are discovered, resulting from diffusion of the kinetic variables in the laser beam and representing a new type of transverse effect under optical bistability. The phenomenon of "self-tuning" of the strata against the background of autooscillations, the spontaneous generation of traveling pulses under Gaussian pumping, and new homogeneous modes are studied: oscillations near the various positions of equilibrium and switching between them; generation of single pulses in response to a weak signal in driven optical multivibrator mode, and non-trivial transient processes during switching. 7 illustrations, 19 references.

UDC 535.8:539.213

Holographic Self-Magnification in Amorphous Films of As_2S_3

[Synopsis of article by P. Ketolaynen, O. A. Ozols, V. Ya. Pashkevich, M. Ya. Reynfelde, O. Salminen, P. Silfsten and K. K. Shvarts]

An experimental investigation of the effect of holographic self-magnification (GSU) in As_2S_3 films is carried out. Results are presented on GSU in a

broad range of initial diffraction efficiencies $10^{-6} < \eta_0 < 1$ percent. The degree of GSU is higher as η_0 is less, and there is no GSU threshold clear down to η_0 on the order of 10^{-6} percent. The maximum self-magnification at given η_0 and specimen thickness corresponds to a period of the holographic grating Λ = 1.5 mcm. Excitation of GSU by longwave light (632.8 nm), if the holograms were first recorded by shortwave light (514.5 nm), was also observed. It is concluded that the GSU in amorphous As_2S_3 films is mainly due to the phane component of the holograms and incoherent for thin holograms. 3 illustrations, 6 references.

UDC 535.36:535.21:537.226

The Fine Structure of Four-Wave Cross-Scattering Rings of Light

[Synopsis of article by V. V. Lemeshko and V. V. Obukhovskiy]

It is found that the indicatrix of four-wave cross-scattering of light in crystals of $LiNbO_3$:Fe has a complicated structure, consisting of a sequence of closely spaced emission peaks. The characteristic spacing between adjacent maxima of the indicatrix is ~10' (fine structure). It is shown that the appearance of such structure is due to peculiarities of the four-wave interactions in materials with local response. 3 illustrations, 10 references.

UDC 535.37

Photoluminescence of Silver Thiogallate $AgGaS_2$

[Synopsis of article by V. A. Gusev, A. P. Yeliseyev, B. G. Nenashev and A. P. Sedelnikov]

The photoluminescence of crystals of silver thiogallate $AgGaS_2$ of stoichiometric composition after roasting at 930°C for 30 days in an atmosphere of Ag_2S+S was investigated. For the first time, infrared luminescence (1550 nm) was discovered and shown to be quenched by laser light. The spectra of excitation of luminescence in the visible spectrum (495, 680 nm) and IR luminescence are studied in detail. The primary centers of recombination are attributed to manifestation of defects involving sulfur vacancies. 2 illustrations, 7 references.

UDC 535.372:537.227

Characteristics of Luminescence of Lithium Iodate

[Synopsis of article by A. P. Yeliseyev, L. I. Isayenko and G. L. Noskov]

Defects in "acid" and "neutral" lithium iodate are studied by methods of x-ray and thermostimulated luminescence (RL, TSL). RL is characterized by a wideband spectrum in the visible region, caused by internal defects. In the region 100-230 K, spontaneous pyroelectric luminescence is superimposed on the RL and TSL. The characteristics of manifestation of the latter under

the action of ionizing and laser radiation are studied in dependence on the conditions of production of the crystals. 2 illustrations, 10 references.

UDC 538.566:621.383

Acoustooptical Interaction in Ti:$LiTaO_3$ Waveguides

[Synopsis of article by V. V. Atuchin, K. K. Ziling, D. V. Petrov and A. V. Tsarev]

An experimental and theoretical investigation of acoustooptical interaction (AOV) in Ti:$LiTaO_3$ waveguides is carried out. It is shown that the effectiveness of the AOV in lithium tantalate waveguides is 3-4 times less than that in lithium niobate waveguides. A conclusion is made as to the possibility of using AOV in Ti:$LiTaO_3$ waveguides for creation of AO-elements with little sensitivity to optical damage in the visible spectrum. 1 table, 1 illustration, 12 references.

UDC 621.396.6

Measurement Microprocessor Controller With Analog-Digital-Analog Channel in CAMAC Standard

18630113e Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 13 Apr 87) pp 78-80

[Article by V. L. Tsymbalenko]

[Abstract] A microprocessor controller based on type K580 microcircuits is described. The single-chip K580IK80A processor, K580GF24 generator and K580BK28 system controller make up the central processor element. The device also contains 2K of RAM, 2K of ROM, and eight-channel twelve-bit ADC with 30 ms cycle time, 212-bit DACs, 824-bit parallel I/O port and CAMAC asynchronous parallel bus interface. The controller is mounted on a 1M board. Figure 1; references 6: Russian.

UDC 536.53;536.587

High-Speed Accumulator for Nuclear Quadruple Resonance Signals

18630113d Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 20 Jul 87) pp 76-77

[Article by V. P. Anferov, S. V. Molchanov and O. D. Levchun, Kaliningrad State University]

[Abstract] The unavailability of the series-manufactured high-speed multichannel storage units and specialized computers for recording of nuclear quadruple resonance signals stimulated the authors to develop a multichannel storage unit with temporary conversion of the analog signal to digital code, which is stored in semiconductor memory. Operation of the unit is very briefly described. Figures 2; references 2: Russian.

UDC 621.377.6.307

Incremental Memory Module for Recording Spectrometric Information

18630113c Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 5 Jun 87) pp 74-76

[Article by A. A. Zhuchkov, Institute of Molecular Genetics, USSR Academy of Sciences, Moscow, and A. I. Myagkikh, Pacific Institute of Oceanography, Far-Eastern Division, USSR Academy of Sciences, Vladivostk]

[Abstract] An incremental memory device has been developed for direct connection with the bus of microprocessor systems such as the KR580. The device is designed to record differential energy spectra of nuclear radiation, decreasing the number of hardware elements required and simplifying the procedure for reading of data from the unit. The incremental memory unit can also be used in multichannel pulse counter mode. Figure 1; reference 1: Russian.

UDC 621.317.75

System for Storing and Processing Images of Nonrepeated Electrical Signals From Very High Speed Oscilloscope Screen

18630113b Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 5 Feb 87) pp 69-73

[Article by M. V. Vysogorets, A. F. Myasnikov, M. Yu. Petrov, V. N. Platonov, V. Ye. Postovalov, A. M. Prokhorov, V. P. Simonov, P. L. Sokolova, A. D. Chulkin and M. Ya. Shchelev, Institute of General Physics, USSR Academy of Sciences, Moscow]

[Abstract] A system is described for storage and processing of images from the screen of a very high speed oscilloscope, based on a cooled CCD matrix, in contact with the fiber-optical screen of a very high speed oscillograph, through an electronic-optical brightness amplifier. A special dialogue digital image processing software package is used to process the images. The system has a wide bandwidth for input, analysis and processing of two-dimensional images from the screen of a picosecond electronic-optical measurement system, evaluate and correct distortions characteristic of picosecond cameras, estimate signal parameters and measure the space and time spectra of images. Figures 4; references 11: 5 Russian, 6 Western.

UDC 681.323:535.8

OPTAN Digital Image Processing Television System

18630113a Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 6 Jan 87) pp 65-69

[Article by M. P. Lisitsa, V. N. Arefev, N. V. Latyshenko, S. V. Polishchuk, A. V. Stolyarenko, S. B. Ryazanov and I. M. Yunakov, Institute of Semiconductors, Ukrainian Academy of Sciences, Kiev]

[Abstract] A description is presented of the OPTAN interactive television digital image processing system, which uses a 256 x 256 x 6 image format. The system can operate with pulsed (fractional picosecond) or continuous radiation sources. An image can be stored in 20 ms. Image input is by television camera in real time or from magnetic storage media. The software used with the system allows it to be employed as an optical multichannel analyzer or high-speed digital storage oscilloscope. Examples of oscilloscope and spectrograph images before and after digital processing are presented, illustrating the capacity of the system for image clarification. Figures 3; references 9: 6 Russian, 3 Western.

UDC 681.327

Device to Interface S7-9 Stroboscopic Oscilloscope With "Elektronika D3-28" Microcomputer

18630113f Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 1 Aug 87) pp 80-81

[Article by R. A. Bagautdinov, Kh. G. Bogdanova and D. Sh. Idiatullin, Kazan Physical-Technical Institute, Kazan Affiliate, USSR Academy of Sciences]

[Abstract] An interface is suggested to avoid difficulties associated with automation of the measurement of high-speed periodic processes due to the limited speed of existing analog-digital converters by interfacing a type S7-9 stroboscopic oscilloscope and an Electronika D3-28 computer using an ordinary F7077/2 ADC with a resolution of 3 μms. The operating sequence of the device is described. The device is intended to automate studies of periodic electrical signals several orders of magnitude shorter than the ADC operating time. The time resolution of the measurement system is up to 200 points per ns. Figures 2; references 3: Russian.

UDC 681.3:531.78.2

Attachment to Direct Memory Access Adapter for Input of Images to Computer

18630113g Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5 Sep-Oct 88 (manuscript received 25 Sep 87) pp 82-83

[Article by D. Ye. Konash, Minsk Institute of Electronics]

[Abstract] A device is described which is designed for high-speed input of images with limited resolution but a broad range of brightnesses into micro- or minicomputer memory. The device is an attachment for a direct memory access adapter described in an earlier work. The information source is any video source which uses the television standard. The brightness level at each point of the image is coded with a machine word. Input time is 1 ms. Figure 1; references 3: Russian.

UDC 681.325.5

Measurement Circuit Processors

18630110a Moscow IZMERENIYA, KONTROL, AVTOMATIZATSIYA in Russian No 2 Aug 88 pp 14-20

[Article by E. I. Tsvetkov, doctor of technical sciences]

[Abstract] The major functions performed by the processors in measurement and computer devices and systems are control of measurement procedures, processing of measurement information and direct participation in generating the measurement results. It is in this last case that the processor is a part of the measurement circuit and performs a portion of the measurement procedure in numerical form. This article presents a history of computer processors in measurement circuits and a description of some of their functions, including scaling, error correction, functional conversion of quantities and iterational and adaptive measurements. Measurement circuit processors can perform measurements which would have previously been impossible, increase the metrologic level by correcting measurement results or measurement circuit characteristics, determine the functional capabilities of measurement circuits under software control and improve the utilization of a priori and previously known information. References 37: Russian.

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